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A

SYSTEM

OF

DISSECTIONS,

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SLAB

EXPLAINING THE

ANATOMY OF THE HUMAN BODY,

THE

MANNER OF DISPLAYING THE PARTS, AND THEIR VARIETIES IN DISEASE.

WITH PLATES.

BY CHARLES BELL.

EDINBURGH:

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1798.

TO

DR. DANIEL RUTHERFORD,

PROFESSOR OF BOTANY IN THE UNIVERSITY OF EDINBURGH, AND PHYSICIAN TO THE ROYAL INFIRMARY,

THIS

FIRST PART

OF A

SYSTEM OF DISSECTIONS

IS RESPECTFULLY DEDICATED,

BY

HIS OBEDIENT HUMBLE SERVANT,

CHARLES BELL.

PREFACE.

For the ſtudy of every ſcience there are required ſuch general views as may enable a ſtudent to take a lively intereſt in his purſuits, to direct his inquiries to the points of true importance, and to confirm in him a manly and ſteady reſolution to perſevere in learning the details and minutiæ, which, although diſagreeable and tedious in themſelves, are yet abſolutely neceſſary. In no caſe is this more indiſpenſable than in the ſtudy of Anatomy; for while the general reſults or economy, conſidered as a whole, are intereſting and important, the details are intricate, and difficult to be acquired, and often diſagreeable. There are thus two departments of this ſcience; both equally neceſſary, but to be ſtudied in a very different manner.

What is detailed in elementary books of anatomy is too often repreſented as comprehending the whole of the art. Yet the object of ſuch books is not practical anatomy; by which is to be underſtood the real inveſtigation and knowledge of the diſſected body. The deſcriptions are not adapted to the limited and ſucceſſive views which, in diſſection, we muſt have of the parts: they cannot be implicitly followed as guides; but, on the contrary, the anatomy of any part to be diſſected, or of parts implicated in a great operation, muſt be collected from many different ſources—muſcles from one place, blood-veſſels from another, and nerves from a third. The deſcriptions, too, will be found inſulated and defective in ſuch views as can give a lively intereſt and knowledge of the mutual dependence of the parts. Now elementary books ſhould give ſimple, introductory, and connected views; otherwiſe they are not only uſeleſs, but become hurtful. To ſtudy the details of anatomy, without having the parts before us, is pernicious: and a man, who has, by reading only, acquired a knowledge of names, and of the derivations of nerves and arteries, without at the ſame time being able to put his finger upon the body and tell what parts lie concealed, is more apt to be led aſtray, to heſitate and be timorous, than to be prompt and deciſive in his conduct as a ſurgeon.

That the common books are not ſuited to be aſſiſtants in diſſection, every one muſt allow, who has taken the knife into his own hands, or been attentive to the operations in a diſſecting room. He will know, that, in diſſection, it is not the want of minute deſcription that is ſo much felt, as the want of arrangement, and plans upon which to proceed.—How often is

it found, that young men, who have begun their anatomical labours with a true conviction of the importance of the ſubject, and with the moſt determined reſolutions to combat all difficulties which might oppoſe themſelves to their progreſs, have, for want of a plan and ſyſtem of proceeding, gone to work in ſo diſorderly a manner, that they have been ſoon bewildered, and forced, in diſguſt and deſpair, to give up a purſuit, which, with their views better directed, would have been moſt plain, and certainly moſt valuable to them. The conviction of the want of ſome guide to the younger ſtudents in theſe labours, has emboldened me to this attempt.

The object of this work is to ſerve as an aſſiſtant to the ſtudent in acquiring a knowledge of Practical Anatomy; in gaining a local memory of the parts; in learning to trace them upon the dead ſubject, and to be able to repreſent them to his own mind upon the living body. This being my object, the method to be purſued is obvious: to give a ſhort detail of the anatomy; to ſhow how the parts are to be laid open, and how they are to be diſtinguiſhed in diſſection, or avoided in an operation; to explain the conſequence of each part to the great functions of the body, and to mark the diſeaſes to which it is liable.

In the execution of a plan of ſuch importance, much allowance muſt be made; for it is a wide and difficult field: and the illuſtrations ſhould be drawn from the whole range of our ſcience. But if, by attendance in the diſſecting room, and by a careful obſervation of the difficulties under which ſtudents labour in their firſt attempts, I have been enabled to facilitate, in any degree, their introduction to this important ſcience, I ſhall indeed be highly gratified.

INTRODUCTION.

As it is of conſequence even to thoſe who have no intention of attaching themſelves to Practical Anatomy, to be yet acquainted with the common methods of injecting and preparing the parts, I ſhall enumerate here the chief circumſtances to be attended to as introductory to a common courſe of diſſection, that they may be concentrated, and the anatomy freed from needleſs repetition. Practical Anatomy, like all arts where an aptneſs and dexterity of the hands is neceſſary, is to be acquired not haſtily, nor by precept; but an eaſe and certainty in its operations can be attained only after much aſſiduity and labour. All that I have to offer, then, may be ſaid in a few words; and I ſhall confine myſelf to the management of injection, and the means employed to facilitate the diſſection and the demonſtration of minute parts.

Injection has been the great inſtrument in the hands of modern anatomiſts, and has led to many uſeful diſcoveries; but it is much to be regretted, that, like other ſubſidiary aids, this has often been miſuſed, and its reſults too implicitly truſted to; that, while in many inſtances it has been fortunately employed to ſilence phyſiological diſputants, it has, on the other hand, too often allowed animoſity to harbour in the intricacy of its proofs. But this at leaſt is ſatisfactory, that, in ſpite of every diſadvantage, the art of injection has contributed to the rapid advancement of our ſurgical knowledge.

To thoſe commencing their operations, ſmall ſubjects will be found the moſt convenient, being more eaſily managed, and not likely to embarraſs the ſtudent with much confuſion: and, beſides, his views at firſt are not ſo immediately directed to practice; but his object ſhould be to acquire general ideas of the anatomy. Young ſubjects are likewiſe much fitter for injection (I mean for the injection of the arteries, and for minute injection): they are not only more eaſily heated and managed, but, what is of more conſequence, their blood-veſſels have that elaſticity and ſtrength which enables them to bear the puſh of the injection better, and, by a kind of elaſtic reſiſtance, to give warning of the danger of rupturing their coats; while, in old bodies, the piſton of the ſyringe goes eaſily down ſo far, ſtops, and, if forced, moſt probably burſts the veſſels, driving the injection amongſt the muſcles, and giving much trouble in the diſſection. When any of the trunks burſt in this way, the tenſion being taken off, their coats contract upon the warm injection, and they remain half filled.

In old age, this want of pliancy becomes very remarkable. There is often a kind of ſtiffneſs and rigidity, as if the coats of the veſſels were corrugated; a degree of that ſtate in which we find the arteries when oſſified, or when concretions are formed in their coats.

If only ſome coarſe injection is in a ſlovenly manner to be thrown into the great veſſels to ſhow their courſe, it does not ſignify how it is done, or what injection is uſed, or what means are employed to facilitate the paſſage of the injection. But if the veſſels are to be injected minutely, it is neceſſary previouſly to heat the ſubject well, by bathing it in warm water, or applying ſteam to the ſurface. This is of more conſequence than even the choice of the ſubject; for, as the injection is intended to be penetrating and fluid when warm, and, upon becoming cold, to congeal and remain ſolid in the veſſels, it is neceſſary that the veſſels be heated, that they may not ſuddenly chill the injection: and this heating of the body ſoftens and relaxes all the maſs of fleſh, and brings it to a more ſuitable ſtate for admitting injection. But it ought to be remembered, that, if the parts be overheated, eſpecially where the veſſels to be

injected lie expoſed, there is danger of ſpoiling all, by corrugating their coats, and making them quite friable and tender. There is a better way ſtill of heating the ſubject; viz. by heating the veſſels themſelves: and, indeed, the two methods ſhould be always united. The common practice in the injection of the great veſſels, is, to inject firſt equal parts of brown and white ſpirit varniſh, coloured with the ſame paint that is uſed for the coarſe or wax injection; and this fine varniſh injection, being moderately heated, and thrown in before the wax injection, clears its way, and moderately heats the veſſels, ſo that they do not readily cool or retard the wax injection which is to follow. But when uſing minute injection (which is ſize coloured with vermilion) for the purpoſe of demonſtrating the minute veſſels, although the hard injection is thrown into the veſſels after it, ſimply to ſtop the regurgitation of the warm and liquid ſize, and to retain it in the minute extremities of the veſſels, yet it infallibly happens that the wax injection runs more minutely in this way than in any other. This being the caſe, it will be found, in all caſes, to be a better method to uſe painter's ſize, coloured with vermilion, and heated, but not ſo much as to criſp the veſſels; and to throw it in before the coarſe injection. It is the leaſt expenſive, runs more minutely, gives always a chance for beautiful ſpecimens of minute injection, and can be puſhed to any quantity, even till the ſkin of the limb becomes quite tenſe, without rupturing the veſſels, or thoſe veſſels at leaſt by which the coarſe injection can eſcape. By this means, the veſſels are dilated, the limb made warm and moiſt, and the wax injection flows eaſily into the arteries, whilſt the ſize eſcapes with the flighteſt preſſure into the cellular texture.

I have ſeen great care taken to exclude air and water from the arteries previouſly to the injection, leſt they ſhould retard it, or break its continuity in the arteries when cold: but often, upon an emergency, equally good injections of the arteries may be made by throwing in abundance of warm water before the wax. This, however, is not a practice generally to be followed; but it ſhows that it is rather a mixture of water or air alongſt with the injection in the ſyringe, which is to be avoided; for, in that caſe, they will certainly be mixt in the veſſels; which will be found, upon cooling, with the wax broken and interrupted in them.

In the veins, on the contrary, if there be any air or water in them previouſly to throwing in the injection (at leaſt in the extremities, where, on account of the valves, it is neceſſary to inject from the branches towards the trunks), the injection is then confined to the great veſſels; and the air or water, not being allowed to eſcape by exudation, muſt remain interrupting the wax. The moſt effectual way of avoiding the mixture of air with the injection in the ſyringe, is, after having drawn it full, to hold up its point. This allows the air to riſe to the top; and before introducing the nozle of the ſyringe into the pipe, the piſton ſhould be puſhed gently, till the injection appears at it.

The ſucceſs of the injection of veins depends entirely upon their being well waſhed with warm water, and repeatedly dilated, as they are for the moſt part foul with coagulated blood, eſpecially in old people; although, in other reſpects, the veins of old ſubjects are in the beſt ſtate for injection, being enlarged and varicoſe. The coagula muſt frequently be drawn out of the mouths of the larger veins before introducing the tube. If the veins of the thigh and leg, for inſtance, are to be injected, the tube ſhould be fixed in a ſmall vein upon the fore part of the foot, near to the great toe; and a ſtop-cock ſhould alſo be fixed into the external iliac vein, within Paupart's ligament. Then the blood muſt be waſhed out by throwing in tepid water from the tube at the toe; firſt, with the ſtop-cock open; and afterwards, when the veins are a little cleared, the ſtop-cock at the top of the thigh is to be ſtopt, and the veins a little diſtended, and the limb immerſed in warm water. Before injecting, the veins muſt be completely emptied by opening the ſtop-cock, and ſtroking up the thigh. The coarſe injection ſhould be thrown in while the limb is thus completely warm, and without any fine injection being thrown in before. During the injection, the ſtop-cock at the groin ſhould be kept open, and ſome one placed to turn it when the injection appears at the mouth of the vein.—In this way, the air or water will be driven freely before the injection; and veins,

which would otherwiſe remain empty, will be filled; for, by the dilatation, the valves loſe their power, become too ſmall for the diameter of the veſſels, and allow the injection to go backwards into the branches.

In filling the arteries with coarſe injection, when extravaſation or rupture of the veſſel happens, it ſeems ſtrange that the rupture is commonly in the trunk, and not in the ſmaller branches, ſince we know that the ſtrength of the larger veſſels is owing to their greater elaſtic reſiſtance, whilſt that of the leſſer arteries ariſes from their muſcular power, which muſt ceaſe in the dead body. But there is an evident reaſon for this: The rupture of the arteries often happens from uſing the injection too hot; and as the great heat of the injection is in part corrected before it gains the extremities, they are not affected by it; while the root or trunk of the veſſel being perpetually expoſed to the hot ſtream, its coats are corrugated, and conſequently burſt. Beſides, as the injection, when it cools, plugs up the ſmaller branches, the force of a heavy and unwary hand is exerted upon the trunks, where, the injection being yet fluid, they are dilatable. Accordingly we find, that, in throwing in cool and fine injection, the rupture is always towards the extremities.

From all this it may eaſily be underſtood why at firſt the piſton is to be puſhed ſlowly and gradually whilſt throwing in the fine injection; inſinuating the fluid into the more delicate veſſels, which are very eaſily ruptured; ſcarcely preſſing at firſt, but allowing the piſton to go down with its own weight, and gradually increaſing the force. The coarſe injection again is to be thrown in with a ſmart puſh. This is the great delicacy in injection; and to accompliſh it without danger of rupturing the veſſels, is to be acquired only by practice.

There are ſtill other things which require attention; viz. the tying of all collateral veſſels that may have been opened, and the fixing of the tube ſecurely in the mouth of the veſſel. When the injecting pipe is introduced into the veſſel, it cannot be retained there by a ſimple knot, without a chance of its ſlipping off during the injection, or, if tied firmly, of cutting the coats of the veſſel. Therefore, after the ligature is drawn upon the artery including the tube, the ends of the ligature ſhould be brought over the wings of the tube, and then carried round ſo as to include that part of the ligature which reaches from the mouth of the tube to the wing; and being tied there, the former knot is tightened, and the mouth of the artery drawn up upon the barrel of the tube.

The coarſe injection is compoſed of the following ingredients:—Bees wax, ſix ounces; reſin, eight ounces; turpentine varniſh, ſix ounces. The wax and reſin give hardneſs and conſiſtency; and the varniſh is added to give it pliancy. Theſe colours are generally uſed: Vermilion, king's yellow, flake white, ſmalt, verditer, verdigriſe, lamp black. They ſhould be mixed with the turpentine varniſh, and then added to the wax when melted; and ſhould there be occaſion to melt the injection a ſecond time, the heat muſt be cautiouſly applied, leſt the colours ſhould be burnt and deſtroyed. The injection ſhould not be thrown into the veſſels while too warm, for it will hurt their coats. The degree of heat ſhould be ſuch, that the finger can be allowed to remain in it for a little while.—A coarſer compoſition may be made with tallow, wax, ſpirit of turpentine, and oil, coloured with the coarſer paints; or, ſimply, tallow and red lead, when the parts are not to be preſerved. And for minute injection, turpentine, coloured with vermilion, (which Haller preferred to all other injections, for running minutely, and without extravaſation); painter's ſize, coloured with any of the above paints; or equal parts of brown and white ſpirit varniſh.

It has already been obſerved, that the limbs, or any part of the body, are eaſily dilated by the minute injection, in conſequence of its eſcaping into the ſmaller veſſels. This muſt in ſome meaſure be prevented when it is intended to diſplay the minute vaſcularity of membranes and joints, and more eſpecially the vaſcularity of bones; for while the injection freely eſcapes into the dilatable cellular membrane, it will never penetrate into the more reſiſting parts, as the bones and cartilages. Therefore, when a mi-

nute injection of the bones and cartilages is intended, a bandage muſt be rolled from the toes to the upper part of the limb, not very tight, but ſo as to reſtrain the enlargement of the muſcles and cellular membrane by the force of the injection. In this way, the minute veſſels are filled, yet little extravaſation allowed; for there is an equal reſiſtance in the ſoft parts and in the bones, and the parts partake more equably of their natural proportion of the colouring fluid. By this precaution, I have been enabled to inject the bones very ſucceſsfully, ſhowing all the ſtages of oſſification. And not in ſound limbs only, but in caſes of diſeaſed bones, with open ulcerated ſurfaces, I have ſucceeded in the injection, by firmly bandaging the limbs; when, otherwiſe, the injection would have readily eſcaped, and important morbid preparations have remained uſeleſs.

Although the great difficulty of preparing the bones lies in the injection of them, yet much remains to be done in making them tranſparent, that their vaſcularity may be ſhown; in the manner of cutting the cartilages to ſhow the progreſs of oſſification; and there is even ſome difficulty in expoſing their texture, independently of their vaſcularity, as by eroſion, burning, and maceration. Very young ſubjects are better for ſhowing the vaſcularity of bones. But by this we are not to underſtand that the veſſels of bones are more numerous at their formation than at their full growth; for the natural bony ſtructure of the body is always liable to be abſorbed, and therefore muſt be profuſely ſupplied with ſecreting veſſels, ſo as to be ſtill within the action of the ſyſtem. Were this not the caſe, their abſorption would be marked by their total decay, inſtead of the bone being perpetually renovated. Therefore the veſſels muſt be as intimately diſtributed in the interſtices of the bony matter, and as capable of their functions in a full-grown bone as in the bone of a child.—In extreme old age, we are to underſtand, from the writers on the ſubject, that the veſſels are contracted and obliterated, loſt in the increaſing proportion of the oſſeous depoſition; but when an artery loſes its functions, the parts to which it belongs are dead, and out of the living ſyſtem; and if it happen that bones, unſupplied with veſſels, remain enveloped in the living parts, it ſeems at leaſt to be contrary to the prevailing laws of the economy, as a part, when dead, is thrown off from the living ſurface.

The minute vaſcularity of a bone is to be ſhown, after injection, by a long maceration of it in diluted muriatic acid; which, by diſſolving the earthy part of the bone, leaves the fibrous part (in the interſtices of which the earth was depoſited) flexible, and without any character of bone but the form. In this ſtate, it is like cartilage, ſoft and yielding, but apparently fibrous: but the veſſels will ſtill be no more diſcernible than before. The bone is to be thoroughly dried, and then plunged into a glaſs of clear ſpirit of turpentine; when, as ſoon as the ſpirit penetrates the cells, the bone becomes quite tranſparent, and the veſſels eaſily diſtinguiſhable, branching through its ſubſtance.—In corroding ſhells to ſhow the glutinous baſis in which their earthy part is laid, ſpirit of wine, with a little of the acid dropt into it, has been uſed, by which the delicate web is preſerved, whilſt the other parts are taken away. In the ſame manner, in the maceration of bones, when the maceration is expected to be tedious, it may be neceſſary to add ſpirit of wine to the menſtruum to prevent the ſize in the veſſels from being reſolved and waſhed away. —The moſt beautiful preparation of bone is the ſimple ſection of the cartilage, or apophyſis, in young ſubjects, where the injection has run minutely, and while the nucleus of bone is ſtill ſmall and red with injection. This nucleus is ſeen lying in the middle of the cartilage, with the veſſels crowding from the ſurface towards the centre, and terminating in the bone; or perhaps only a ſmall and delicate artery is ſeen puſhing into the centre of the cartilage, and terminating in a point the beginning of a future bone. The cartilages in this ſtate, when cut in thin ſlices, and ſuſpended in ſpirit of wine, are beautiful; or when thoſe ſlices are dried, and ſuſpended in ſpirit of turpentine, the cartilage becomes ſo tranſparent, that it is with difficulty diſcerned in the fluid, and nothing is ſeen but the nucleus of bone, with the arteries beautifully ramifying to ſupply it: Or the nucleus of bone may be tinged by ſolutions of ſome of the metals in acid, while the cartilage will remain perfectly white. Such preparations may be infinitely va-

ried, forming the moſt beautiful examples of the changes going on, not only in the bones, but, by analogy, in the whole body.

The marrow, alſo, may be diſplayed, after injection, by maceration in water; or by ſlitting up the cylindrical bones, and preſerving them in ſpirit of wine. When ſuch a ſection of a bone is dried, and put in oil of turpentine, the veſſels ſupplying the marrow bags, being collapſed to the ſide of the bone, are ſeen in great profuſion.

The ſtructure of bone is demonſtrated, independent of injection, by maceration and burning. By expoſing bones gradually to a red heat, and ſo placed that they may be equally ſupported, the animal part is burnt away, whilſt the earthy part remains behind, a calcareous phoſphate, retaining the figure of the bone, but deprived of its gluten and fibrous part, which gave it ſtrength. This is juſt the reverſe of what takes place in the corroſion with the muriatic acid. In the one caſe, the animal fibre is burnt away, leaving the ſecreted bony part in its original figure; in the other, the calcareous or oſſeous part is diſſolved in the acid, the ſofter parts (which, when endowed with living properties, were capable of ſecreting this earthy part from the blood) remaining undiſſolved. Theſe preparations, therefore, ſhould be contraſted.

If a bone is burnt, and then put in acid, it is entirely deſtroyed. If, therefore, after burning it completely, warm wax be poured into its cavity, and it then be corroded in acid, the cells will be elegantly caſt in wax.

Corroded preparations are the moſt elegant of all, requiring great care. They are generally made of the injections of the ſolid viſcera; as the heart, lungs, liver, kidney, and ſpleen. Harder injection than common is required for theſe, and no minute injection need be thrown in before. If the injection ſucceed, the only other delicacy is to place the preparation while the injection is yet warm, as it is intended to remain, and where the corroding acid may be eaſily applied. When the fleſhy part is diſſolved, it is to be gently waſhed away by the agitation of the water; and it ſhould not be attempted to be lifted out of the water till entirely freed from the parenchymatous matter, which, by its weight, might break the delicate branches. The menſtrua are the muriatic and nitric acids; the latter of which M. Sue found a more perfect menſtruum, and leſs apt to affect the colours of the injection, or the minute veſſels.

Compoſitions of glaſs may alſo be uſed in making caſts of many parts, as they admit of a great variety of tranſparent colours; the ſoft parts and the bones being burnt away, while the paſte is acquiring its glaſſy ſurface.

In preparing morbid parts, there are often appearances, curious and important, which cannot be preſerved. Often, in examining the parts, the colour is the only criterion by which the nature of the diſeaſe is to be determined; and this it is often impoſſible to preſerve. Recourſe muſt be had to painting, to give the lively tints which alone remain of the diſeaſe; as in inflammation, gangrene, &c. But even here injections may be of much ſervice, as a means of making the parts more beautiful or natural, and more extenſively uſeful, by unravelling that intricacy which ſo often occurs in wet preparations having no diſcrimination of colour. Even in organic affections of the heart, lungs, inteſtines, &c. injection gives a ſplendour and conſequence which the real importance of theſe parts would perhaps claim in vain; and in preparing ſuch parts, great expertneſs may be acquired in giving them natural or beautiful tinges, by injecting the veſſels with coloured fluids.

In preſerving thick fleſhy parts in ſpirits, it will be ſometimes neceſſary to inject ſpirits into their veſſels; which, thoroughly pervading them, tend greatly to preſerve them. Liquors for preſerving preparations have been much boaſted of ſince the time of Ruyſch; but to clean and unadulterated ſpirit of wine there can be no objection. It muſt, however, be diluted according to the delicacy of the parts to be immerſed in it. Sometimes, when very delicate fleſhy membranes are put up in pure ſpirits, they will be

found next day ſhrivelled and ſhrunk up to the top of the jar: but by ſaturating the ſpirits with ſugar, they loſe this property, and the membrane hangs looſely in the jar. The glaſſes containing ſuch membranous parts ſhould be allowed to ſtand ſome time before being finally cloſed: for though the membrane, being full of water when firſt put into the ſpirits, hangs elegantly enough; yet, when it has parted with its ſuperabundance of water, and received the ſpirit, it will become ſo light, that it will ſwim upon the ſurface, and require little hooks of glaſs to be put to its lower part to weigh it down.—Wet preparations often require to have the ſpirits changed upon them ſeveral times before they are finally put up; to prevent the poſſibility of their tinging the ſpirits after they are cloſed; or, perhaps, it may be neceſſary that the parts ſhould be ſtuffed, or held out in particular poſtures, till they be ſo hardened, that they may remain unſupported in the jar. For this purpoſe, diluted muriatic acid and nitrous acid combined, is ſometimes uſed; or the diluted nitrous acid ſimply; or a ſolution of alum and common ſalt. Theſe give the parts firmneſs and ſtrength to ſupport themſelves in the glaſs. Care muſt always be taken to macerate the parts well previouſly, and to free them entirely from blood.

When delicate membranes are to be injected either with quickſilver or with fine ſize, inſtead of tying all the veſſels by which the fluid may eſcape, I have found it neceſſary only to ſear the edges of the membrane with a heated iron; or, after having fixed the tubes, the common method is to dry the edges all round, while the middle part is kept ſoft and moiſt. When it is required to demonſtrate the vaſcularity of a part where there is no opportunity of injecting it, if membranous, the blood may be detained in the veſſels by quickly drying and varniſhing it. The blood, when extravaſated, or when (as in the piles) preternaturally collected in veſſels, may be coagulated by a ſolution of alum; or blood in inflamed parts may be coagulated by diſtilled vinegar. In other inſtances, as in preparations of the lacteals, their natural fluids may be coagulated and preſerved by plunging them ſuddenly into ſtrong ſpirits.

There are many parts of the body which it is impoſſible to keep for any time in their original beauty, and theſe the moſt delicate and intereſting; as the organs of the ſenſes, and all minute nervous parts, the villi of the inteſtines, the comparative anatomy of inſects, the incubated egg, &c. The ready demonſtration of ſuch delicate parts in the freſh ſubject is the trueſt teſt of the abilities of the practical anatomiſt; for there is more delicacy and nicety required in expoſing theſe parts, and more real benefit to be derived from them, than in making the more laſting preparations.—The minute ſtructure of many of theſe parts muſt be diſſected and unravelled under water, where the looſe and floating membranes diſplay themſelves; while, out of the water, they would lie collapſed and undiſtinguiſhed. In ſuch inveſtigations, I have found nothing of ſo much ſervice as jelly made ſtrong and quite tranſparent. When a delicate part is completely diſſected (ſuppoſe it to be the coats of the eye), place it in the jelly as it is becoming firm, and hold out the parts; and they will be retained, elegantly diſplayed, either for demonſtration or for drawing.

In other inſtances (as in diſſecting the eye and ear), freezing mixtures have been employed, which will allow the frozen parts to be diſſected without the fluids eſcaping.

Boiling and maceration are often employed to demonſtrate the muſcularity of parts; as the courſe of the fibres in the heart. The courſe of the fibres in the bladder may alſo be ſhown, by diſtending it, and plunging it ſuddenly into boiling water. In this way, alſo, the coats of arteries, the ræte mucoſum of the ſkin, &c. may be demonſtrated. Immerſing the ſkin in boiling water before injection, is ſaid to make the villi ſtand out more from the ſurface. Although immerſing in boiling water will not ſeparate membranes into their layers, ſometimes alternately macerating them in cold and warm water will do it.

Boiling gently with a ſolution of nitre and alum is uſed to render evident the muſcularity of membranous parts. The ſolution makes the muſcular fibre of a red colour: but, perhaps, minutely injecting the

parts is a more natural and effectual method; for, after a ſucceſsful injection, the muſcular fibres of the bladder, for inſtance, being very vaſcular, become diſtinguiſhable.—Nervous membranes, as the expanded nerve of the eye and ear, and the membranes of the egg, become opake when vinegar is poured upon them. Without this, the latter cannot be diſtinguiſhed.

The brain and nerves, by being expoſed to the oxygenated muriatic acid, are made firm, and brought to a better ſtate for diſſection. In ſhort, there is a great field for ingenuity in this kind of inveſtigation.

Lately many diſcoveries have been made, and much written upon the ſubject of abſorption, and the ſtructure of the lymphatics; and the diſputes and wranglings about quickſilver injection has entailed a degree of conſequence upon it, which, perhaps, it does not merit, either from the comparative elegance of the preparations, or from its uſe in fitting ſtudents to purſue their more important ſtudies. Yet ſuch is the faſcinating power of the examples which have been given, that I have ſeen many ſtudents who could attend to nothing elſe; till, poring over the ſubject in ſearch of lymphatics, they have dreamt the greateſt abſurdities in the way of diſcovery. The doctrine of abſorption has been brought to its preſent conſiſtency by the labours of a few ingenious men; and luckily, while hypotheſes have been forming, the mechanical dexterity in their demonſtration has been brought to its preſent perfection. Upon this laſt ſubject there have been treatiſes written profeſſedly; and much ſcattered information will be found in the pamphlets of Dr. Monro and Dr. Hunter,—in the writings of Hewſon, Sheldon, and Cruickſhanks. As theſe are books which every perſon reads who wiſhes to be acquainted with the opinions reſpecting lymphatic abſorption, and the facts upon which ſo much of the modern phyſiology is founded, it would be needleſs for me to give any details here.

As to the manual operation of diſſecting, there can be little ſaid. To hold the knife eaſily in the hand, not rigidly,—to lay the edge fairly to the part,—and to cut with a ſteady and uniform ſtroke, has a good appearance: but the beſt rule in this, and all ſuch operations, is, to avoid all affectation of manner.—In diſſecting muſcular parts, the uniform rule is, to diſſect always in the direction of the fibre; and, in lifting the integuments, to puſh the knuckles ſo behind them as to ſtretch the cellular membrane, which connects them with the muſcle. The knife is to be kept cloſe to the muſcles, and carried in the length of the fibres, ſeparating a faſciculus of them at each ſtroke. By this means, what is diſſected will be fair and clean, and the direction of the fibres will be diſtinctly ſhown: on the contrary, if a muſcle is attempted to be diſſected by firſt taking off the integuments and then cleaning it, bit by bit, it will be found a very tedious and irregular operation. Yet it muſt be remembered, that, in proceeding in this manner with muſcles having faſcia and aponeuroſis coming off from them, there is ſome chance of taking away theſe in part along with the maſs of the integuments; and when minute veſſels are to be diſſected, it is impoſſible to take the integuments thus off at once: the cutis only muſt be taken away, and the cellular membrane left to be diſſected more cautiouſly from betwixt the veſſels.—In no diſſection ſhould any more of the integuments be taken off from a part than is neceſſary at the time; and, upon any interruption, the integuments ſhould be carefully replaced; for, when diſſected parts are left open, they contract a mucus, or become dry and unſeemly.

The ſciſſors are too little uſed in diſſection, as the uſe of the knife is ſuppoſed to make good operators: but it is always of more importance to be well acquainted with the parts which ſhould be cut, than to diſplay too great a management of the knife.

From what I have ſeen of private diſſection, I would rather adviſe thoſe who are deſirous of undertaking a complete courſe of diſſections, not to begin their labours with learning all the muſcles of the body; for this, beſides other diſagreeable circumſtances, is a dry and tedious taſk at firſt.—It will perhaps be found more truly uſeful to begin their diſſections with general views to the economy of ſuch parts as, from lectures or books, they know to be of importance; then proceeding, in a more determined way, to

ſtudy rigidly the anatomy of the bones and muſcles, and accidents of the great joints,—the blood-veſſels and nerves, and the anatomy of the great operations of ſurgery.

During diſſection, there are many little operations which ſhould be practiſed, and which are neglected. The introducing, for example, of probes into the ducts; as into the naſal duct, and into the ducts of the ſalivary glands: the introducing of inſtruments into the noſe and throat, and into the Euſtachian tube: the uſe of the probang, and of the catheter, &c.—Knowledge and dexterity in ſuch points often prove more uſeful, as being oftener required, than the greater operations of ſurgery.

A SYSTEM OF DISSECTIONS.

PART I.

CONTAINING

THE DISSECTION OF THE ABDOMINAL MUSCLES AND VISCERA.

A

SYSTEM

OF

DISSECTIONS.

DISSECTION

OF THE

ABDOMINAL MUSCLES.

THE diſſection of the abdominal muſcles is often the firſt that a ſtudent ſees; and if it be carefully done, he is aſtoniſhed to find the fleſhy maſs of the body ſeparated into ſo many diſtinct parts, and is pleaſed with the appearance of the muſcles expoſed in all their beautiful variety of ſhapes and colours, the ſmoothneſs of their ſurface, and their ſilvery expanded tendons. But he conceives all this to be the ſimple expoſition of the parts, not the effect of perſevering labour; and if accuſtomed to the clear demonſtration of a claſs diſſection, has no idea of difficulty in the taſk. He feels the difficulty of diſſection only when he takes the knife in his own hand, directed by that vague knowledge alone, which is, I fear, too common, and which conſiſts more in a facility of repeating deſcriptions, than in a preciſe and clear idea of the ſituation of the parts. To begin a courſe of private diſſections with ſuch light ideas of the difficulty and importance of the taſk, and ſo poor a knowledge of practical anatomy, muſt produce in the ſtudent that diſappointed and irritated ſtate of mind which is but ill calculated to carry him on with perſeverance. He will find that there are many little obſervations to be made, and much accurate knowledge to be acquired of the appearance of parts, of veſſels, of cellular ſubſtance, faſcia and tendons, before he can go on confidently, and be ſure of the courſe of his knife.

No diſſection ought to be begun without maturely conſidering the parts which lie concealed, and all that is moſt worthy of labour. Following this method, I ſhall firſt deſcribe the general outline of the parts to be diſſected; and, ſecondly, the order of the diſſection, and the points that ought to arreſt attention.

FIRST STAGE OF THE DISSECTION.

In your firſt diſſection you have only one muſcle on each ſide of the belly to diſſect; for the outer oblique muſcle covers all the others.

The OBLIQUUS EXTERNUS ABDOMINIS ariſes by triangular fleſhy ſlips from the lower edge of the eight lowermoſt ribs, (Plate I. Fig. 1. A.); its muſcular fibres proceed downwards obliquely over the cartilages of the ribs, and alſo obliquely downwards over the free ſpace (B) betwixt the borders of the cheſt and the ſpine

of the ilium. Terminating its muſcular part abruptly, it ſends its expanded tendon (a b c) over all the fore part of the belly, and is inſerted into the ſpine of the ilium (n), Poupart's ligament (o), into the os pubis, and into the whole length of the linea alba (a a a), which is only the interlacing of this with the tendon of the muſcle of the oppoſite ſide.

Dissection.—Making an inciſion through the integuments from the ſternum to the os pubis, and croſſing it with another paſſing immediately below the umbilicus, and round the ſide in the direction of the curve of the ilium, you diſſect the lower flaps from the lower part of the belly, laying them over the thighs—and the upper flaps, when diſſected, you lay over the breaſt. In doing this, you perceive that you have two very different ſurfaces to diſſect. 1. The muſcular fibres of the obliquus externus, lying on the ſide betwixt the ribs and ilium (B); and the thin layers of its fibres (p) which lie upon the ſurface of the thorax, and which are very apt to be deſtroyed in firſt lifting the integuments; and, 2. You have to diſſect the expanded tendon on the fore part of the belly (a b c). In diſſecting the muſcular part, you will find it covered by a thin expanſion, adhering cloſely to the fibres—and if you take the fat and integuments off, leaving the muſcle with the cellular ſubſtance and ſlight aponeuroſis adhering to it, you will never make a clean muſcle, however carefully you afterwards diſſect it. You are therefore to carry your knife cloſe to the ſurface of the muſcle, and to diſentangle its fibres from the membranous covering and integuments, by long and equable ſtrokes, carried in the direction of the fibre. This is the method which you ought to purſue in all muſcular diſſections, when there is no faſcia to be expoſed, nor branches of injected veſſels to be avoided. But you are not to proceed in the ſame manner in the tendinous and fore part of the abdomen, at leaſt in your firſt attempts; for you would be in danger of lifting the outer layers of this ſheet of tendon of the external oblique muſcle, and, led away by the appearance of a beautiful ſhining ſurface (which may be nothing elſe than the tendons of the lower layer of muſcles), deſtroy the beauty of the parts, and make confuſed and irregular work. Therefore take off the integuments in a maſs from the fore part of the belly; and when you ſee all the general ſurface expoſed, you cannot proceed far in diſſecting off the condenſed cellular ſubſtance from the ſurface of the tendon, without obſerving the confuſion into which ſuch irregularity will lead you.

In the courſe of the diſſection of this ſingle muſcle, all theſe points muſt be minutely attended to—the linea alba (a a a)—the linea semilunaris (b b b)—and the anatomy of the ring (d).

To underſtand theſe lines which divide the tendon of the external oblique muſcle, it is neceſſary to remember the ſituation of the recti muscles*. They reach from the ſternum to the os pubis. Each ariſes from an extenſive adheſion (q) to the outer ſurface of the ſternum, and to the cartilages of the ribs, and proceeding down in the middle of the belly, included in an appropriated ſheath, is inſerted into the os pubis. This ſheath is ſtronger upon its outer part, becauſe when the body is ſtrongly bent forwards, and the ſurface of the belly is concave, the recti muſcles, were they held only by the elaſtic ſkin, would ſtart from their places, and make a direct line from the ſternum to the pubis; but this ſtrong ſheath in which they are included, being compoſed of the tendons of the broad muſcles, bends as they bend, and conſequently the recti acting thus in a curve, act more powerfully in drawing the thorax towards the pubis. The ſheath of each rectus muſcle, as I have ſaid, is formed by the tendons of the flat muſcles of the belly, proceeding from behind forwards. Theſe, when they reach the ſide of the rectus muſcle, mingle their tendons more intimately together, which appears externally as a white ſemilunar line (b b b) running round in the direction of the ſkirts of the rectus muſcle—and theſe broad tendons ſplitting again, include the rectus in their duplicature, and meeting beyond that muſcle, form the tendinous white line in the middle of the belly called the linea alba (a a a). The rectus muſcle does not run unconnected in this ſheath, nor does it form one continued tract of muſcular fibre; but the intermediate tendons

* The rectus muſcle of the right ſide is ſeen, Plate I. F F F. On the left ſide, the rectus muſcle may be diſtinguiſhed through the expanded tendon of the obliquus externus.

which divide it into ſquare muſcular portions (F F F) are firmly connected with the ſheath, while the muſcular part adheres to it by looſe cellular ſubſtance. Therefore when the external muſcle of the belly is carefully diſſected, you can diſtinguiſh theſe parts: *Firſt*, The origins of the muſcle from the ſide of the thorax, coming down in thin layers over the ribs (A p). *Secondly*, A ſtronger and more fleſhy part winding round the ſide betwixt the falſe ribs and the ilium (B). Then the expanded tendon on the fore part of the belly divided by the linea alba (a a a), which goes up the middle of the belly—and the linea ſemilunaris (b b b), running up from the os pubis in a curved line, a little to one ſide. In the ſpace included betwixt theſe two lines, you may obſerve indiſtinctly the rectus ſhining blue and livid through the tranſparent tendon of the oblique muſcle, and interſected with white interſtices or ribs formed by its intermediate tendons (c c c).

The Ring.—But the moſt important part of this firſt diſſection ſtill remains to be deſcribed, viz. the anatomy of the ring. When diſſecting the lower part of the abdomen near the pubis, you find the fibres of the tendon coming down obliquely to be inſerted into the ligament of the thigh; and indeed the ligament of the thigh (o) is nothing but the ſtrengthening of the tendons of the external and internal oblique muſcles at this place, where they paſs over from the ilium to the thigh, are continued into one another, and form a ligament which allows the veſſels of the thigh (f g) to paſs freely out from the belly. Diſſecting ſtill nearer the pubis, juſt as the tendon is about to be inſerted into that bone, you ſee it ſplitting (at d) and allowing the ſpermatic cord (e) to ſlip through its fibres,—and then meeting again, its fibres croſs each other, and are at the ſame time firmly implanted into the creſt of the os pubis—Continuing to diſſect the integuments off theſe parts, and a little down upon the thigh, obſerve the ſituation of the femoral artery (f)—of the epigaſtric branch (i)—of the ſpermatic cord (e)—and all the parts implicated in the femoral and inguinal hernia.

In taking off the ſkin from the groin, you find a confuſed and irregular aponeuroſis coming off from the abdomen, and going down upon the thigh, apparently made up of, or ſtrengthened by, the cloſe intermixture of cellular ſubſtance. At this part you find it covering the femoral artery; the inguinal glands (h) lying without it, and the vena ſaphæna major ſinking through it to join the femoral vein, about an inch below Poupart's ligament. You find alſo, where the thigh is injected, the ſmall arteries riſing perpendicularly from the great trunk, to ſupply theſe glands, and the other ſuperficial parts. This irregular aponeuroſis being in the femoral hernia matted and condenſed by inflammation, forms a coat, which muſt be cut through before the peritoneal ſac is opened.

After diſſecting and obſerving the natural texture and ſituation of this aponeuroſis, and its probable changes in diſeaſe, ſacrifice it to a more important demonſtration, or leave it on one thigh, while you proceed with the diſſection of the other. Thus, taking away theſe confuſed parts, expoſe neatly the ligament of the thigh. Diſſect the artery and vein in the angle of the groin, where they lie imbedded. Then, diſſecting delicately with your ſciſſors, under the ligament, you find proceeding from the upper part of the femoral artery, two branches; the arteria circumflexa ilii (k), and the epigaſtric artery (i). The firſt of theſe you find running back along the inſide of the ligament, towards the ilium, to inoſculate with the ilio-lumbar artery; the latter is the more important, the epigaſtric artery. You may obſerve the direction of its courſe (in the Plate it is marked by a dotted line, as it lies under the muſcles); it runs up upon the inſide of the tendons of the abdominal muſcles, making its way to the rectus muſcle, on the inſide of which it climbs, even till it inoſculate with the internal mammary, which is the firſt branch of the ſubclavian artery. In this courſe it croſſes the upper part of the ring, and croſſes the ſpermatic cord. Now, you obſerve that the femoral hernia, coming down on the inſide of the femoral artery, the epigaſtric artery and the ſpermatic cord muſt paſs before the neck of the ſac, ſo as to hinder the free inciſion of it when ſtrangulated; and you ſee how difficult it muſt be to cut thread by thread exactly in the middle point betwixt the epigaſtric ar-

tery and the cord, eſpecially when you recollect how different the appearance of theſe parts is in hernia, after continued inflammation. You may obſerve the relative ſituation of theſe parts in Plate I. Fig. 2. A, the gut; B, the epigaſtric artery; C, the cord.

Theſe are parts of ſuch importance, that you ought to conſider them in every poſſible ſhape in which they can occur. You ſee that the direction of the inguinal hernia muſt follow the courſe of the cord, that it will be nearer to the pubis, and higher up: that the ſeat of the femoral hernia is in the flexure of the groin; and that if the hernia is not very large, and the parts ſwelled, the ring, and the cord from the ring to the teſticle, ſhould be free. You have to obſerve how the arch, which is formed by Poupart's ligament, over the veſſels and muſcles coming from within the belly, is filled up with fat and cellular ſubſtance, and how the veſſels lie imbedded in it. You find the vein lying more towards the pubis than the artery, and the ſmall inguinal branches of the artery riſing to ſupply the inguinal glands; theſe arteries ſometimes bleed profuſely in opening buboes in the groin.

SECOND STAGE OF THE DISSECTION.

Presuming that you have paid equal attention to the diſſection of the muſcles of both ſides of the belly, you proceed thus: Diſſect off the ſerrated origines of the external oblique muſcle from the ribs, and from the ſpace between the ilium and falſe ribs, and detach it from the obliquus internus (D E) which lies below it. You will recollect that the obliquus internus aſcends from the ilium (n), ſpreading its fan-like fibres in a direction which forms an acute angle with the fibres of the external muſcle which you are diſſecting off. Continue to ſeparate the external and internal oblique muſcles, till you find them firmly attached by their tendons to the linea ſemilunaris. Betwixt them there is interpoſed ſome looſe cellular ſubſtance, which mars the beauty of the lower muſcle if not carefully diſſected away—and you find them connected by the branches of the arteries and veins piercing them to gain the ſkin and cellular ſubſtance. Obſerve the origines of the obliquus internus abdominis from the ſpine of the ilium (n), and apparently alſo from the maſs of muſcular and tendinous origines of the muſcles of the back (you will find it very difficult to diſſect its origines from the ſpine, as deſcribed in books). Thoſe fibres of the muſcle which originate from the back part of the ſpine of the ilium, run directly upwards (D) to the cartilages of the falſe ribs. From the fore part of the ilium its fibres are continued more in a direction acroſs the belly, and from its loweſt portion (E) which runs directly downwards in the direction of the external oblique, you find it ſending off, behind the external ring, a delicate faſciculus of fibres (r) which inveſt the ſpermatic veſſels, and forms the origine of the cremaster muscle.

The belly of the internal oblique muſcle ends in a uniform edge, and its tendon is finally inſerted into the linea ſemilunaris: but here it is to be remembered, that ſome anatomiſts have deſcribed its tendon as ſplitting into two layers, one forming, with the external oblique, the outer part of the ſheath of the rectus; the other forming the inner part, with the tendon of the tranſverſalis abdominis.

This inner oblique muſcle, when diſſected, ſhould be left in its ſeat, and the outer muſcle replaced over it. Then making an inciſion by the ſide of the linea alba, which opens the ſheath of the rectus, you diſſect it back towards the linea ſemilunaris. In doing this you muſt ſeparate carefully the ſheath from the tendinous bars of the rectus muſcle, for at theſe parts they are firmly blended together. Towards the bottom of the ſheath, you find the pyramidal muscles (G) running up from a broad origine upon the os pubis, to an acute point inſerted into the linea alba. The two pyramidal muſcles riſing together, one on each ſide of the middle abdominal line, form a cone that is ſometimes obſervable, ſhinning through the ſtrong ſheath which covers them. Theſe parts being completely diſſected, return them to their former place; and having continued the diſſection of the muſcles of the other ſide exactly in the ſame manner proceed after this method:

Plate I

Fig 1

Fig 2

Drawn by C Bell *Pub^d as the Act directs* *Eng^d by I Bew*

The tendon of the internal oblique muſcle is to be cut from its connections with thoſe of the other muſcles at the linea ſemilunaris (b b): Then diſſect the muſcle back towards its origine upon the ſpine of the ileum; and laying it over the haunch, you have an opportunity of obſerving the courſe of the TRANSVERSALIS ABDOMINIS.—You find its fibres running acroſs the belly, more in the direction of the external oblique, than in that of the laſt diſſected muſcle. You ſee it ariſing fleſhy, from ſix of the lower ribs, upon their inſide, (which has allowed ſome anatomiſts to deſcribe minutely its digitations with the diaphragm); and tendinous, from the maſs of muſcles upon the loins. It runs a little round towards the ſide, where the ſtrongeſt part of the muſcle is formed. It ariſes likewiſe from the ſpine of the ileum, and even from the outer part of the ligament of the thigh. It is inſerted into the linea alba, having previouſly connected itſelf with the linea ſemilunaris. It will be obſerved, that towards the lower part of the belly, this muſcle appears deficient, and the bowels are ſeen through the peritoneum, the outer ſurface of which is covered with much confuſed cellular ſubſtance, and unlike its ſmooth inner ſurface, which is applied to the inteſtines.

Theſe parts being thus diſſected, can be demonſtrated in ſuch various views, and with ſuch quick ſucceſſion, lifting and replacing them, that they cannot fail to be effectually underſtood. And having carefully obſerved their ſtrict anatomy, no one can be at a loſs to recapitulate their general characters and uſes.

It may be obſerved in the ſkeleton how great a ſpace there is to be covered from the edge of the thorax to the brim of the pelvis, and backwards to the ſpine; and recollecting, that in this ſpace are contained the ſoft viſcera of the abdomen, and that theſe muſt be ſuſtained by an elaſtic and yielding covering, it will be underſtood how this covering, whilſt it ſupports the viſcera, and yields to and aſſiſts the operation of the diaphragm, muſt ſupport and poiſe the whole trunk upon the pelvis; and that although the muſcles of which it conſiſts be thin and delicate, yet, having ſo great a lever as the edge of the thorax, while the centre of motion is at the ſpine, it bends the upper part of the body with great force.

THE Diſeaſes connected with the Anatomy of theſe Muſcles are, HERNIA, DROPSY, and ABSCESS.

It is wrong to cut acroſs the belly in opening collections of matter amongſt theſe muſcles, unleſs they have been deſtroyed by the matter; becauſe the fibres of the muſcles are then cut acroſs, hence they retract, and form a gap; and at the ſame time the poſſibility is increaſed of wounding the epigaſtric artery which runs up the belly. By opening theſe abſceſſes with an inciſion parallel to the fibres of the muſcles, the parts are divided, without allowing the muſcles to retract; and the chance of wounding the arteries is leſſened. In tapping for the dropſy, it is ſaid that the epigaſtric artery (the courſe of which I have marked in the Plate with a dotted line), is ſometimes wounded, or its accompanying vein. But it ſhould be expected, when theſe were wounded, that while the canula remained in the wound, diſtending the orifice, they ſhould not bleed. If they ſhould bleed, however, they may probably be ſtopped by preſſing the canula obliquely to one ſide. I have never ſeen an accident of this kind; but ſuch caſes have been deſcribed to me, where the deluge of waters was coagulated in the tub. Perhaps an enlarged ſpleen, or ſome of the viſcera touched with the trochar, may ſometimes account for ſuch a bleeding.

N. B. See, for a deſcription of the Ring in Hernia, No. III., containing the Anatomy of the PELVIS and THIGH.

DISSECTIONS

OF THE

VISCERA OF THE ABDOMEN.

FIRST DISSECTION.

Of the Manner of Opening the Body, and obſerving the general Situation of the Viſcera.

As the great uſe of diſſection is to acquire the knowledge of the parts in the living body, it is proper, before opening the belly, to read the general deſcription of the parts;—to learn the boundaries of the abdomen; the ſituation of the diaphragm, encroaching upon the cavity of the thorax; the tract of the inteſtines; and the place of the more important viſcera;—how the liver and ſtomach are received within the margin of the ribs, and guarded by them;—how the arch of the colon winds round under theſe; and how the ſmall inteſtines are collected in a group under the navel. It is of importance to mark the ſituation of all theſe parts, and to conceive which ſhould be wounded by pointed inſtruments, puſhed in various directions. A wonderful degree of accuracy will thus be acquired in thoſe points, which are of the greateſt importance both to the Phyſician and Surgeon.

In opening the belly*, if the operator be not too finically inclined, a ſimple crucial inciſion is made; one cut from the ſcorbiculus cordis to the pubis, keeping to the left ſide of the navel; and another croſſing it from the ſpine of one ilium to that of the other, coming below the navel, that there may be an opportunity of ſeeing the remains of the umbilical vein continued into the liver. In doing this, the only care ſhould be to avoid cutting the inteſtines, by raiſing the integuments from the viſcera, after the firſt puncture. Having thus laid open the belly, it will be ſeen whether the preconceived ideas of the ſituation of theſe parts be correct.

The following are the points to be obſerved, and which will lead on, without confuſion, to a full demonſtration of the whole.

1. The GREAT ARCH OF THE COLON (Plate II. Fig. 1. and 2. a a a), mounts up from the os ileum of the right ſide, croſſes the belly under the edge of the liver (o) and brim of the thorax, and deſcending again upon the left ſide, ſinks under the ſmall inteſtines, and reſts (at b) upon the wing of the os ileum; thus ſurrounding the ſmall inteſtines, which lie together in the middle of the belly.

2. The STOMACH will be found retired under the ribs, and covered by the arch of the colon: And,

3. The OMENTUM will be found (Plate II. Fig. 1. d d, and Plate IV. Fig. 3. c c), proceeding from the ſtomach and colon, which lie contiguous, and ſtretching down over the ſmall inteſtines, a delicate and expanded membrane, loaded with fat.

Such is the general appearance upon the firſt opening of the abdomen. But as one part of the inteſtinal canal may happen to be more inflated than another, this regularity will ſometimes be diſturbed. The ſtomach may be diſtended, and the colon flaccid and empty; conſequently, inſtead of the colon be-

* I ſpeak here as if a new ſubject were beſtowed on this demonſtration; but there is no neceſſity for it.

ing the prominent part, it may ſeem to have ſubſided, and be ſcarcely diſtinguiſhable from the ſmall inteſtines, while the ſtomach may puſh out its white expanded ſides from under the liver and the ribs of the left ſide: or perhaps the ſtomach and colon may have both receded, by the expanſion of the ſmaller inteſtines. Now, in this ſtate of the inteſtines, if an attempt be made to unravel them with the hands, there is every probability that they will be tumbled into greater confuſion and diſorder. It ſhould be remembered, that in the examination of all theſe parts, the colon is the ſure guide; for the caput coli (Plate II. Fig. 2. e), is fixed down by the peritoneum to the loins, upon the right ſide; and from this the colon can be always traced up under the ſtomach, and above the ſmall inteſtines. This portion is called the Arch of the Colon (a a a); and if you puncture it, and introduce a ſmall blow-pipe, and blow it up, then every thing ſeems to take its true place. As the colon ſwells up, it ſhows its ligamentous bands, and the cells ſo peculiar to it. It is ſeen riſing before the ſtomach, deſcending upon the left ſide, and under the ſmall inteſtines, and finally tied down by the peritoneum to the loins upon the left ſide, forming at this place the ſigmoid flexure of the colon (Fig. 1. and 2. b), which is the laſt portion of this gut. From this point to the anus, the continuation of this inteſtine is the RECTUM (Fig. 2. f).

In this firſt diſplay of the viſcera, there is a very partial view of the inteſtines: Only a part of the colon, jejunum, and ileum is ſeen; and to trace the whole length of the alimentary canal, this natural order muſt be deranged.

COURSE OF THE INTESTINES.—Finding the great curvature of the ſtomach, and the arch of the colon connected by the omentum, ſeparate them, by detaching the omentum from its connection with the colon, and lay the great inteſtine down over the ſmall inteſtines. You then find the ſtomach lying obliquely acroſs the upper part of the belly, towards the left ſide, a conical bag, bent upon itſelf (See Plate IV. Fig. 3.); ſo that the two ends approach, forming on the under ſide a greater curve (g g), and on the upper ſide a leſſer curvature (f). The greater curvature preſents itſelf in this view of the parts. The cardiac orifice, or entrance of the œſophagus (h), lies out of ſight; and even the pylorus (L) recedes out of ſight when the ſtomach is diſtended. Towards the left ſide, under the ribs, and hanging on the great curvature of the ſtomach, you find the SPLEEN (See Plate IV. Fig. 1. g), of a dark and livid red colour. You ſee the DUODENUM, the firſt inteſtine (Plate II. Fig. 2. g, and Plate IV. Fig. 1. and 3. e) taking a turn upwards from the pylorus (Plate IV. Fig. 1. L, and Plate II. h), ſtretching a little to the right ſide, then turning upon itſelf, and deſcending under the meſocolon. Obſerve how it is bound down at this point; obſerve alſo its ſituation with regard to the ſtomach and liver, and arch of the colon; and remember that it is here within this ſpace that it receives the pancreatic and gall ducts (See Plate IV. Fig. 2.). Neither of theſe ducts can be ſeen in this ſtage of the diſſection, the pancreas itſelf (as repreſented at p p), being obſcured in the cellular ſubſtance at the root of the meſocolon—and you may feel it under the ſtomach, a hard conglomerated maſs, ſtretching directly acroſs the ſpine. The true extent of the duodenum is from the orifice of the ſtomach (Plate II. Fig. 2. h), to the place where the gut emerges from under the meſocolon (i). It lies before the emulgent veſſels, before the aorta, and upon the laſt vertebra of the back. It is larger than any of the other ſmall inteſtines, and ſometimes is very greatly diſtended.

Turning back the colon and omentum, fixing them over the brim of the thorax, and puſhing down the ſmall inteſtines towards the pelvis, you find the duodenum coming out from under the colon, but ſtill tied cloſe to the ſpine by the peritoneum, or lining membrane of the abdomen. After a little ſpace, the inteſtine extricating itſelf from the ligamentous folds of the peritoneum, is ſeen riſing up, and coming forward, and is called the JEJUNUM (k).

You have now to unravel thoſe of the ſmall inteſtines, which lie below the arch of the colon, as they at firſt preſent themſelves to you. The ſmall inteſtines are the DUODENUM (which you have already examined), and the JEJUNUM and ILEUM. Theſe two laſt comprehend the whole length of the ſmall inteſtines

below the meſocolon, the lower end of the ileum terminating in the caput coli, or beginning of the great inteſtines.

The JEJUNUM (k) is ſo called from being found more empty than the ILEUM (l); but this muſt not be truſted to. It is ſaid alſo, that it is of a redder colour, and more vaſcular and more abounding in the valvular proceſſes of its inner coat; but this diſtinction may be rejected with ſafety, as authoriſed by Haller. In preſcribing the limits of theſe two inteſtines, anatomiſts are reduced to the neceſſity of ſuppoſing them to be divided into five parts; two of which they give to the jejunum, and three to the ileum; which, ſhowing the neceſſity of an arbitrary diviſion, is therefore uſeleſs. It is ſufficient to obſerve, that theſe ſmall inteſtines may be pretty regularly divided into two maſſes, eſpecially when inflated; that the upper portion, and that more to the left, is the jejunum, while the lower is the ileum; and that the ſituation of this laſt expoſes it to hernia, eſpecially on the right ſide. Very generally the portion ſtrangulated is about a foot diſtant from the caput coli. Where the ileum enters the caput coli, there is a ſoft pendulous projection of the inner coat, forming a valve at the termination of the ileum. When the caput coli is inflated and dried, this valve appears like two tranſverſe membranes, ſtanding obliquely acroſs the inteſtine, the one projecting over the edge of the other; ſo that matter endeavouring to paſs from the large inteſtines into the ileum, ſhuts the tranſverſe ſlit. *Bidloo*, 39. Tab.

The GREAT INTESTINES form the laſt diviſion of the inteſtinal canal. Tracing the inteſtines according to the courſe of the food, the firſt turns, or the convolutions of the portion neareſt to the pylorus, (as at k), are ſituated further down in the belly than the laſt turns of the inteſtines; and theſe you find even lying contiguous to the ſtomach, as the great arch of the colon (a a). They certainly differ in their functions and uſe from the others, and ſeem to be the receptacle of the food which has already run through the more active ſmall inteſtines. They form few convolutions; but being very capacious, although ſhort, they fill a great ſpace in the belly. They are commonly divided into the COECUM, COLON, and RECTUM; but it is ſurely better to divide them into the colon and rectum, and to ſubdivide the colon, as conſiſting of parts having a variety of ſhapes, and very different in their ſituation, into theſe three portions: FIRST, The CAPUT COLI (e), where the colon is tied down to the loins of the right ſide, comprehending the valve of the ileum, the cœcum, or properly, the beginning of the colon, lying in the ſpace under the right kidney, hid by the convolutions of the inteſtinum ilion (Plate II. Fig. 1. e). Obſerve upon the outer ſide of the cœcum a little appendage, like a twiſted earth-worm, and thence called APPENDICULA VERMIFORMIS (m, and Plate III. m). SECONDLY, From the caput coli you trace the colon, mounting upwards over the face of the kidney, and connected with it by cellular ſubſtance (See Plate III.). A little further up, you find it tinged with the bile (ſhowing that it has lain contiguous to the gall bladder), and then going acroſs the upper part of the belly, forming the GREAT ARCH OF THE COLON (Plates II. and III. a a a). In this part, and in its whole courſe, you will obſerve its peculiar ſhape, notched into cells by the ligaments of the colon; which, running in the length of the gut, ſlip thin fibres into the interſtices of theſe cells, and ſeem to form them by conſtricting the gut. THIRDLY, The colon then deſcends upon the left ſide, and going backwards, under the ſtomach and ſpleen, into the left hypochondrium, and then deſcending over the kidney of this ſide, it is connected with it, and is again tied down, but leſs perfectly than on the right ſide, forming ſome remarkable turns from the general direction, of which this part is called the SIGMOID FLEXURE of the COLON, (Plates II. and III. b). The LAST diviſion of the inteſtinal canal is the RECTUM (Plates II. and III. f). Drawing aſide the inteſtines, which reſt in the hollow of the pelvis, you find the great gut continued down from theſe convolutions directly (as its name implies) to the anus, turning over the ſacrum, and inclining a little to the incurvation of that bone.

The LIVER.—Replacing the inteſtines, you have to obſerve the ſituation and general figure of the liver. You find the upper ſurface convex, anſwering to the concavity of the diaphragm. The under ſurface is irregularly concave, anſwering to the parts it has to receive; it is thick backwards, and on the

fore part laps over the ſtomach and colon with its thin extenuated edge. Its ligaments rather connect it with the neighbouring parts, than ſupport it; and theſe connections are diſpoſed ſo as not to interrupt its gentle motion in reſpiration, but tie it to the diaphragm, the moving part.

The PERITONEUM.—One great object to be ſtudied in this the natural ſituation of the bowels, is the peritoneum—and the knowledge of this membrane muſt include the whole general anatomy of the abdomen. It has been invariably the cuſtom of anatomiſts to pay much attention to the courſe of membranes, not only in the belly and breaſt, but in the more delicate organs, and to trace them in all their windings, deriving one inflection or proceſs from another. But one may eaſily conceive how all the inveſting membranes or ſurfaces of the viſcera and muſcles, and of all the variety of parts contained in the belly, were formed at the ſame time; and that here in the abdomen all the ſurfaces of the inteſtines, of the liver, of the parietes of the belly, or inner ſurface of the abdominal muſcles, have one common nature. That they are all ſmooth, poliſhed, and continually exuding a ſerous fluid, which allows one part to glide eaſily upon another, and to lie in contact without adhering. And as the contents of the belly, though all within one common cavity, do not lie looſe, but are attached, the whole ſurface muſt be continuous. Now every part of the body, as it differs in ſtructure or uſe from that to which it is contiguous, is ſeparated from it by a ſubſtance differing in its nature from both, viz. the CELLULAR TEXTURE. This ſubſtance is elaſtic—eaſily dilatable and contractile—dividing one veſſel from another, and one muſcle from another, without which there would be no action allowed in veſſels, nor motion in muſcles and their tendons; but the whole body would remain a ſolid and inactive maſs. We find in the belly (as in the ſtomach and inteſtines, and in the bladder) one layer of membrane ſeparated from another, where they differ in ſtructure and economy—and ſo the outer layer or ſurface of all the contained parts in the belly has a common nature, which differs in its properties from the parts which it covers, whether the muſcles of the abdomen or the inteſtines—and it is ſeparated from them by interſtitious cellular ſubſtance, and appears, upon careful diſſection, a diſtinct membrane, viz. the peritoneum. If this is to be conſidered in the light of a ſeparate membrane, involving all the bowels in its doublings, then its demonſtration is to be followed in this manner: It is ſeen lining the abdominal muſcles which have been laid back—it can be traced from the lower flap over the os pubis, reflected over the bladder, and again running down betwixt the bladder and rectum—then embracing the rectum, and connecting it to the ſpine, and while it gives eaſy acceſs to its blood veſſels, involving them in its duplicature. When you put down your hand behind the bladder, you find that you can proceed but a little way; your finger is impeded by the membrane being reflected from the bladder upwards over the rectum, thus ſeparating the viſcera of the abdomen from the pelvis. There is no cavity, as it is called, in the pelvis, but the parts are connected by looſe cellular membrane, and it is the motion of the abdominal viſcera which requires the general ſmooth and inveſting membrane. Above, upon the liver, is ſeen in the ſame manner the peritoneum continued from the muſcles of the abdomen over the inſide of the ribs, and under ſurface of the diaphragm; reflected from the diaphragm upon the liver; and forming the broad or middle ligament (LIGAMENTUM SUSPENSORIUM), which reaches down from the integuments of the abdomen, and is inſerted into the upper ſurface of the liver, in a line with the great fiſſure which is on the lower ſurface, (See Plate IV. Fig. I. c). You may obſerve in the edge of this a hard round ligament (b), better felt by the fingers than ſeen; it ſeems to proceed from the umbilicus, and is the remains of the great umbilical vein, which in the fœtus proceeded from the placenta. Drawing aſide the colon and ſmall inteſtines of the right ſide, to have a view of the right lobe of the liver lying deep in the hypochondrium, you may ſee the LATERAL LIGAMENT of this ſide thin and tranſparent, and formed like the others by the peritoneum reflected from the ſurface of the diaphragm. And when you look up under the diaphragm, holding down the liver, you ſee an extenſive attachment betwixt them, which, including a circular portion of the liver, is called the CORONARY LIGAMENT of the liver.

It cannot be conceived that theſe ligaments ſupport the weight of the liver—they are in themſelves delicate—and all the ligaments and proceſſes in the belly, partaking of the nature of the peritoneum, are gradually elongated upon the ſlighteſt extenſion. But were they in every reſpect calculated to ſupport the liver, their inſertion into its ſoft ſubſtance would be unableto bear its weight; it is the equable preſſure of the abdominal muſcles that ſupport it, and all the viſcera of the belly. And it may be obſerved, that the great peculiarity both of the abdomen and thorax is, that the lungs in the one, and the inteſtines in the other, containing each a proportion of air, give a uniform and elaſtic reſiſtance, while the veſſels in the limbs and other parts of the body act under a more incumbent and ſluggiſh weight.

The MESENTERY, MESOCOLON, and LIGAMENTS of the COLON, are formed thus: The lining membrane of the inſide of the belly, when it comes to the ſpine, mounts over and covers all the parts that lie contiguous to the ſpine; inveſting them on the fore part, but leaving them at their attachment to the back, involved in cellular membrane. In this manner are ſituated the kidneys—the great veſſels—the thoracic duct, &c. Theſe may be conſidered as without the peritoneum. But indeed all the contents of the abdomen may be conſidered as equally without the peritoneum—for they lie as if they had forced themſelves forward from their connection with the back, carrying the peritoneum before them. The inteſtines are in this ſituation; the peritoneum coming off from the back bone and loins, on either ſide of the veſſels which go to ſupply the inteſtines, includes them in a double membrane—the meſentery, which, when it reaches the inteſtines, ſeparates again, and, ſtretching over the gut, forms its outer or peritoneal coat. In the ſame manner is formed the meſocolon of the great inteſtine, anſwering to the meſentery of the ſmall inteſtines.

Yet this method of explaining, although in a certain degree it may give a clear and preciſe idea of theſe parts, may be carried too far, and become intricate. The OMENTUM (Plate IV. Fig. 2. c, and Plate II. d d), that delicate, and in many inſtances pellucid membrane, loaded with much fat, which firſt preſents itſelf on opening the body, is deſcribed by anatomiſts as conſiſting of four layers; for being a double membrane (which can be demonſtrated by blowing it up), and each of the membranes being formed by the peritoneum coming off in a double layer, the one from the ſtomach, and the other from the arch of the colon, they thus reckon, as conſiſting in all of four layers of membrane. From theſe connections, this the great omentum has received the name of GASTRO-COLIC OMENTUM. Its connections and double layers are beſt demonſtrated by introducing a large blow-pipe under the great veſſels going to the liver, pointing towards the left ſide, and blowing it up. It may be traced on the left ſide to the ſpleen (Plate IV. Fig 2. g), which it connects with the obtuſe end of the ſtomach running round to the œſophagus, and being continued even into the LESSER OMENTUM (i). This leſſer omentum is found by folding down the ſtomach, and expoſing the under ſurface of the liver. It is a membrane of the ſame nature with the laſt, running back from the leſſer curve of the ſtomach, reaching from the cardiac to the pyloric orifice, and ſpreading backwards to the liver. It forms thus a web, concealing the little lobe of the liver and the pancreas. In injecting the ſtomach, this membrane ought to be carefully preſerved, as it is ſupplied with arteries from the coronary arteries of the ſtomach. There is yet another diviſion of the omentum—the OMENTUM COLICUM, which is continuous with the great omentum, ariſing from the right ſide of the colon, and ending conically above the cœcum.

EXPLANATION OF PLATE II.

In Fig. 1. the view we have of the viſcera when firſt laid open, is repreſented. As partial turns of the inteſtines only are ſeen here, the ſecond figure is added, to ſhow, in one view, the whole courſe of the inteſtinal canal; and as the letters mark the ſame points in both figures, the reader can eaſily find the ſituation of the parts in the body, and their place in the canal.

In both figures, a a a marks the arch of the colon—b, The ſigmoid flexure of the colon—(In Fig. 1. c, The liver—d d, The omentum)—(In Fig. 2. e, The caput coli)—f, The rectum—g, The duodenum, before it ſinks under the meſocolon to appear again at i—h, The pylorus—k, The jejunum—l, The ileum —m, The appendicula vermiformis.

Fig. 1.

Fig. 2.

Drawn by Charles Bell. *Publ. Nov.r 1797 for C. Bell Edin.r as the act directs.* *Engd by R. Scott.*

EFFECTS OF DISEASE UPON THE ABDOMINAL VISCERA.

On this ſubject it is of importance to ſtudy the nature of inflammation, of adheſions, and ſuppuration, and the almoſt uniform conſequence of diſeaſe upon the peritoneum. It will be eaſy, when this knowledge is acquired, to unravel the diſeaſed viſcera, which, without it, muſt appear confuſed and intricate.

Active inflammation ſhould be diſtinguiſhed from turgidity of the veſſels; for often a fulneſs of the veins, mechanically produced, is deſcribed as an active inflammation in the brain and in the pleura, and ſtill oftener in the abdomen. In dropſy, in violent diſtention of the inteſtines, in tympanites inteſtinalis, and after child-bearing the veins of the inteſtines and peritoneum are often found diſtended with blood. But in real inflammation, the peritoneum becomes thickened, pulpy, and leſs tranſparent—the blood is alſo of a brighter red colour; a circumſtance which ſeems not to be owing to a peculiar property in the inflamed part, of preſerving the arterial colour of the blood (as Mr. Hunter ſuggeſts), but to its more general ſuffuſion.

As the eye becomes dry and painful and inflamed when the eyelids are forcibly kept open and prevented from ſpreading the ſecretion upon its ſurface; ſo, when the enveloping membrane of the viſcera is expoſed, the natural ſecretion of its ſurface is deſtroyed, and it is irritated and inflamed. Or, by inflammation from any other cauſe, the ſecretion is deſtroyed; the parts lying in contact are no longer kept ſeparate; they mutually affect each other; and producing a new action, unite.

Adheſions are produced in the peritoneum and inteſtines in a wonderfully ſhort time; and the ſmooth membrane, when it is torn from its new connections, appears cellular; or, upon being cut, thickened, and ſolid—or if the ſurface have undergone ſevere inflammation (without being allowed to form theſe adheſions which are ſo frequently the conſequence of inflamed peritoneum), its ſurface becomes ragged, and numerous floculi of new membranes are formed upon it.

In diſeaſes where inflammation has ſpread among the viſcera, it is generally underſtood that the peritoneum is the original ſeat of the inflammation.—And according to this view of the ſubject, it appears upon diſſection, that the inteſtines do more readily than the muſcles participate in the inflammation of the peritoneum. The muſcles are indeed guarded in ſome meaſure by the looſe cellular ſubſtance, which ſeparates them from the peritoneum. But this does not ſatisfactorily account for what in the above view appears to be ſo great a difference between the ſympathy of the inteſtines and that of the muſcles with the peritoneum. The true explanation ſeems to be, that the diſeaſe or inflammation is in general communicated, not from the peritoneum to the inteſtines, but from the inteſtines to the peritoneum.—It is the diſeaſe of the inteſtines which produces thoſe deadly ſymptoms that are ſaid to mark inflammation of the abdominal cavity; and although there are diſeaſes in which the peritoneum is peculiarly the ſeat of inflammation; yet the inflammation of the peritoneum, produced by any external cauſe, is dangerous only by propagating its inflammation to the inteſtines.

In inveſtigating the ſeat of diſeaſe in the abdomen, the diſſection is very ſimple; for there is ſeldom any neceſſity for minute inquiry. Theſe are the ſtages: Make a crucial inciſion, at once laying open the viſcera—or, if in a female, make your inciſion ſo as to leave a triangular flap to fall over the parts of generation, by continuing your longitudinal cut no further than the umbilicus, and from that point, making an oblique inciſion on each ſide, towards the projecting point of the ilium, forming thus three triangular flaps. Then obſerve whether the parts are in their natural ſituation; examine the omentum, the ſtomach, the ſpleen, the inteſtines, and then the liver and gall ducts. Then ſeparating the ſtomach and colon, connected by the omentum, raiſe the ſtomach, and examine the pancreas—Cutting up the adipoſe

membrane, examine the kidneys, by making a ſection of them. Then following the ureters, examine the contents of the pelvis, &c. In making up your caſe, firſt mark the general deviations from the healthy appearance of the viſcera; then detail the hiſtory of the diſeaſe, and take notice of any anomalous appearances which ſeem unconnected with the principal diſeaſe.

This, in general, is the order of a diſſection of theſe parts for the inveſtigation of the cauſe of death; but it is proper, in the following remarks, to keep to the order of the demonſtrations already given. I ſhall firſt, therefore, conſider thoſe viſcera which lie in the upper parts of the belly, and are ſeen upon folding down the colon and ſmall inteſtines.

Of the STOMACH, DUODENUM, and LIVER.—In examining the body, it will be obſerved how the ſtomach and ſpleen may be wounded by a thruſt apparently into the thorax; or how the lungs and ſtomach, or lungs and liver, may be thruſt through at once. It may alſo be obſerved how the ſtomach and liver lie before the diaphragm, where it goes obliquely down upon the back part of the abdomen; and how they lie contiguous to one another. The effect of hydrothorax, in puſhing down the diaphragm, and depreſſing theſe parts—and the effect alſo of enlargement of the liver, or diſtention of the ſtomach upon the breathing, muſt be obvious. It will alſo be ſeen how a hernia of the ſtomach into the thorax may happen by a rupture of the diaphragm.

The ſtomach is commonly retired behind the colon, and under the ribs. Yet, when ſlightly diſtended, it comes further down in the belly, and aſſumes the place of the arch of the colon. Therefore finding a patient with an open ulcer immediately under the ſcorbiculus cordis, diſcharging the contents of the inteſtines (an inſtance of which I have lately ſeen), it may be queſtioned whether it be an opening from the ſtomach or from the colon. This may perhaps be determined by obſerving the matter diſcharged, whether it be food partly digeſted, as from the ſtomach; or fæces, as from the colon, after having gone through the whole length of the canal.

Ulceration of the inner coats and cancerous tumours of the ſtomach are frequent. Upon the inſide of the ſtomach, inteſtines and bladder, when violently inflamed by any irritation, there is often a general redneſs with bloody ſlime, or there are ſmall blots of florid extravaſation. The few caſes of cancerous tumours of the ſtomach which I have ſeen, accord with the common obſervation, that the upper orifice of the ſtomach is more liable to diſeaſe (owing to its more glandular ſtructure), and more expoſed to injury from ſubſtances ſwallowed. I have ſeen the whole upper half of the ſtomach, with its walls ſo much diſeaſed, that they were not leſs than one inch in thickneſs, with their inner ſurface ſoft and cancerous. This diſeaſe was attended, during the patient's life, with a continual gnawing pain, with foreneſs even upon taking the ſofteſt food, and with extreme pain upon ſwallowing any thing, in the ſlighteſt degree ſtimulating. In diſeaſes of this kind, and where there are tumours projecting into the ſtomach, there is frequent vomiting of black chocolate-coloured blood, which is often attended with fainting.

Contractions of the œſophagus, and upper orifice of the ſtomach, are frequent without any organic diſeaſe. When there is diſeaſe of the œſophagus, the ſtomach is found contracted in breadth, and ſcarcely to be diſtinguiſhed from the inteſtines (HALLER); but it is ſaid, that when the diſeaſe is lower down, the ſtomach is found to be diſtended. I do not know whether this laſt obſervation holds good. The ſtomach, however, is often diſtended ſo as to fill almoſt the whole belly, without any other extraordinary appearance. And in theſe caſes the ſmall inteſtines being compreſſed, obſtinate coſtiveneſs is induced.

That the coats of the ſtomach are affected by its own juices, is now univerſally believed. But, as far as I have obſerved, eroſion is not in ſuch caſes to be expected. Nor are the coats thinner, but they are thickened, gelatinous, yielding, and tender to the fingers; a circumſtance that has often troubled me in injecting the veſſels of the ſtomach. That this is produced by the ſecreted fluid of the ſtomach, unaſſimilated with the food, we are aſſured from the inteſtines not being thus affected, though in the ſame circumſtances with re-

gard to putrefaction. Although it be a common and well founded obſervation, that the ſtomach is extremely delicate, and although the inſtances of ſudden death occaſioned by blows upon it are very frequent, yet there are ſome caſes that would ſeem to form exceptions to this. A young man received a kick in the belly from a horſe. It occaſioned long a conſtant pain in the fore part of the belly, weakneſs and indigeſtion; theſe were ſucceeded by a tedious hectic fever, and at laſt proved fatal. Upon diſſection, the omentum was found folded up and contracted round the ſtomach, forming a ſolid maſs of about an inch and a half in thickneſs, and connecting the ſtomach and inteſtines and liver by its adheſions. The ſtomach itſelf was turned to a bloody grumous cancer. The outlines of this caſe will point out the difficulties which will ſometimes occur in unravelling theſe parts when diſeaſed.

Obſerve the ſituation of the liver towards the right ſide; how far it comes down into the right hypochondrium; and how dangerous and improper it conſequently is to tap on this ſide, the more eſpecially as the liver is often enlarged in dropſy. Obſerve, again, the cloſe connection of the liver with the diaphragm, and how abſceſſes, originally formed in the liver, may, by the ſpreading of the inflammation, and by the adheſions with the diaphragm, communicate the ſuppuration to the lungs, ſo that the matter from the liver may be coughed up from the breaſt; or how hydatids originally formed in the liver may, by the ſame communication, be coughed up from the lungs; or how matter in the liver may, by its natural tendency to the ſurface, propagate the inflammation to the abdominal muſcles, and, by forming adheſions with them, be diſcharged outwardly. In this laſt caſe the adheſions, always preceding the formation and progreſs of matter outwardly, the attachment of the liver and integuments is cloſe and intimate, and the abſceſs points regularly, ſo that the operation is very eaſy. Abſceſs of the liver, beſides being attended with a peculiar painful feeling in the right hypochondrium, is accompanied with a ſharp pain of the ſhoulder and clavicle of the ſame ſide; yet it ſometimes happens, that the liver is ſo little ſenſible, that, upon diſſection, there are found great abſceſſes where the patient, during life, had no complaint. There are, in the writers upon the diſeaſes of hot climates, ſome ſtrange examples of the extenſive communications of theſe abſceſſes.

After having obſerved the intimate connection of the liver, duodenum and ſtomach, it is eaſy to conceive a caſe which not unfrequently happens, viz. a diſcharge of matter into the ſtomach and inteſtines, and even a diſcharge of the food by the external wound, after an operation for abſceſs of the liver; for it has happened, that the abſceſs of the liver has formed connections with the ſtomach on the one hand, and, on the other, opened outwardly upon the ſide of the belly. It will alſo be ſeen how hydatids, getting entangled with the inteſtines, may be diſcharged by ſtool; and how tumours of the liver, pancreas and ſpleen, muſt oppreſs the ſtomach.

With regard to the operation for the collections of matter in the liver, unfortunate miſtakes have been made. There is a caſe mentioned by Haller, of what he calls a ſpurious aneuriſm, in which, upon the tenth rib below the ſcapula, and in the muſcular fleſh of the back, there ſeemed to be the pointing of an abſceſs, which yielded to the fingers; the patient having at the ſame time a ſlow fever, and a jaundiced complexion. They had no doubt of its being an abſceſs of the liver; but the patient died of the violent hæmorrhagy the night following the operation. There is another caſe which brings home to us ſtill more forcibly the importance of an accurate knowledge of theſe parts, and of a lively conception of the effects of diſeaſe upon them. In l'Hopital de la Charité in Paris, the operation for empyema was performed, but no matter flowed from the inciſion. They had been deceived chiefly by the circumſtance of matter being ſpit up from the lungs. Upon diſſection, they found that the matter had been originally formed in the liver, and from it had been communicated to the lungs; but that this communication, having been formed deep in theſe viſcera, no matter could flow from the inciſion. In Ruyſch there is another caſe of a country ſurgeon cutting into the liver, when operating for paracenteſis of the thorax; and the caſe ſhows, at the ſame time, the poſſibility of miſtaking enlargement of the liver with hydatids

for hydrothorax. See in SANDIFORT (*Obſer. Anat. Path.* Lib. III. Cap. V. p. 83. Not. e.), a curious caſe of abſceſs; and indeed inſtances of ſuch caſes are very numerous. It has been found, too, that ſuch is the ſympathy between the ſtomach and liver, that the dreſſings after the operation for abſceſs being too much ſtuffed into the wound, have occaſioned violent bilious vomiting, which was removed upon withdrawing them.

In diſſection, there is frequent occaſion to remark the ſoftneſs of the liver when diſeaſed; and it is neceſſary to obſerve its colour when not diſeaſed, ſo as to be able to judge in any other inſtance how far its colour is natural. Often, in diſeaſe, it is of a lighter colour, or ſpotted and marbled, or its thin edges are found tinged with blood as if inflamed, or perhaps they are found livid, which may ſometimes be produced by the poſition of the body after death, and the gravitation of the blood, as happens in the lungs. At any rate, there is ſeldom active inflammation of the liver. It is often ſchirrous and enlarged, and then aſcites is frequently combined. Its ſchirrous ſtate, when far advanced, is palpable enough; it feels knobby and irregular on the ſurface, and, when cut, the tubercles are generally of a light brown colour. See varieties of theſe in Baillie's Morbid Anatomy. The liver, the kidney, the ſpleen, and the uterus, that is, all the ſolid viſcera, ſeem peculiarly the ſeat of hydatids, but particularly the liver; and from the burſting of the parent ſacs, ſituated in theſe parts, the ſmaller veſicles get entangled with the membranous viſcera.

The laſt circumſtance that ſeems worthy of notice in this part of the belly, is the obliquity of the diaphragm, and the manner in which the parts lie upon it. If there be a tumour formed in any of thoſe parts that are protruded by the action of the diaphragm, ſuppoſe an aneuriſm of any of the veſſels, however the ſurface of the belly may be moved, the pulſation of this tumour will be continual upon the hand; but if the tumour be ſituated upon any of the veſſels whoſe attachment to the ſpine hinders them from being diſplaced by the motion of the diaphragm, then the action of the diaphragm, and conſequent protruſion of the viſcera and integuments of the belly, will give the feeling as if its pulſation were ſubſiding, while the tumour retires from the hand. This circumſtance, ſimple as it is, is the more apt to be overlooked, as a patient, when a phyſician feels his belly, does not breathe regularly, but ſtrains himſelf, and breathes at intervals.

OF THE COLON AND SMALL INTESTINES AS ALTERED BY DISEASE.—Where the arch of the colon croſſes the belly, it lies contiguous to the ſtomach; and here, too, communications are ſometimes formed by diſeaſe. As already hinted, there is ſome difficulty in examining ſuch caſes; for there is much confuſion often, and maſſing together of the parts by inflammation. A caſe from Haller will illuſtrate this: He found in a woman the peritoneum, ſtomach, duodenum, colon, gall-bladder and liver, all grown together into one confuſed maſs, ſhooting fibres out on all ſides, and degenerating on the ſurface into a thick ſoft matter, by which all theſe parts ſeemed to be glued together. There was alſo an ulcer forming a paſſage from the ſtomach into the colon, which was empty; and the ſtomach was diſfigured all round the ulcer, by irregular ſchirrous tumours and abſceſſes. This horrible diſeaſe had gradually come on after a tedious child-bearing.

From the ſhape of the great inteſtines, and from their ſize and greater inactivity, it may be conceived how peculiarly liable they are to congeſtions, and the formation of balls and concretions. Theſe accidents are peculiarly incident to the caput coli upon the right loin, and the ſigmoid flexure of the colon on the left; and we find, in collections of caſes, more frequent inſtances of congeſtions in theſe parts than in any other part of the canal. Theſe concretions are ſometimes formed into balls of amazing ſize, and the inteſtine, contracting round, embraces them cloſely, They are attended with great ſuffering, and continued colic pains, and partial inflations of the inteſtines, with teneſmus and gradual exhauſtion of the body. It has happened, that ſuch balls of immenſe ſize have been diſengaged from their original

ſeat, and have appeared at the anus, and been extracted, like the child's head, with forceps. They are generally formed upon ſome nucleus of indigeſtable matter that has been ſwallowed, *e. g.* ſtones of fruit.

Injuries done to the great inteſtines, either by ſuch congeſtions, or by ulcers and fiſtulous openings, cauſed by any hard ſubſtance ſwallowed (caſes of which are very numerous), are not ſo dangerous as in the ſmall inteſtines, though both are equally liable, in their conſequences, to produce peritoneal inflammation. According to the importance of the function which any part has to perform, is the derangement of its action dangerous to the conſtitution, and painful and diſtreſſing; while, on the other hand, there is no better proof of the danger and bad conſequences likely to be produced by the inflammation of a part, than the pain and general effect which it has upon the economy. In the great inteſtines, the pain is ſharp and rouſing; in the ſtomach, and ſmall inteſtines more heavy, and more oppreſſive and ſickening.

In diſſecting herniæ, where the inflammation of the abdominal viſcera has been violent and ſuddenly produced, I have repeatedly found the SMALL INTESTINES connected more or leſs with one another, not only in the groin, where the ſtrangulated gut adhered, but through the whole extent of the abdomen. But the peritoneum, which lines the abdominal muſcles, I never ſaw connected with the inteſtines in this diſeaſe, unleſs at the part where the gut was confined in the rupture. The alternate action of the diaphragm and abdominal muſcles muſt, by an alteration of the ſhape of the abdomen, produce a gentle and continued friction betwixt the ſurface of the inteſtines and the peritoneal lining of the muſcles, which may tend in ſome meaſure to prevent adheſions betwixt them. But the movement of one turn of an inteſtine upon another differs in this, that they lie together, and follow each other in all the general movements of the belly, and ſo continue in contact until ſeparated by the contraction of one of them when excited by the food. That two portions of the inteſtines, although, when inactive, they lie in contact, do yet, when excited by the food, contract towards the meſentry, receding from their former place, we muſt believe; for we cannot otherwiſe conceive how the food is conveyed down the inteſtines, nor can we account for the varieties in the ſituation of the inteſtines which we meet with in different bodies upon firſt laying open the belly. The movement betwixt the general ſurface of all the inteſtines and the general peritoneum differs, then, from the movement betwixt one turn of the inteſtine and another in this, that the former is gentle, uniform, and conſtant; in the latter, the receding of the parts is greater, but at intervals only, anſwering to the ſtimulus of the food or the activity of the inteſtines. The inflammation and adheſions of the inteſtines extending through the whole belly, while the general inveſting peritoneal membrane adheres only at the ring of the hernia, ſhows at the ſame time, that inflammation is propagated, not by the peculiar nature of the peritoneum, but by the ſympathy among the inteſtines themſelves.

Adheſions thus formed may ſometimes be obliterated again, if the violence of the firſt ſtage do not prove fatal. In the diſſection of a man who died after the operation for hernia, and where the inflammation had been very extenſive, all the ſmall inteſtines were found glued together in one or two ſeparate maſſes; and thoſe, when cut out, and a ſection made of them, looked like a large honeycomb. Very much the ſame appearance occurred in another caſe, where the violence uſed to reduce the hernia, without inciſion, was ſo great as to occaſion mortification of the gut after it had been reduced. In other caſes, where the inflammation had likewiſe been very great, the patient ſuffering long, and at laſt dying, after the inflammation had ſubſided, I have found (which indeed is often met with), bridles connecting the ſmall inteſtines, like the chordæ tendineæ of the heart, an inch and a half in length, ſlender and croſſing over an intermediate convolution of the inteſtine, and holding it thus as if in a nooſe, in imminent danger, one ſhould ſuppoſe, of ſtrangulation. Now, theſe ſtrings muſt once have been adheſions formed by inflammation, and were probably broad and extenſive at firſt, though now ſtretched out to this ſhape by the natural contraction of the inteſtines. Perhaps, if the patient had outlived the diſeaſe, and the inteſtines had regained their ſtrength, ſuch attachments might have been quite done away.

There is another circumſtance to be attended to in explaining thoſe broad adheſions betwixt the inteſtines. The accurate deſcriptions given of the ſhape of the inteſtines and ſtomach apply to them only when out of the body, or when the integuments are laid open, and the preſſure of the abdominal muſcles taken away. In the living body, the viſcera muſt all be in contact with a broad and ſquare ſurface; for, being contained within the abdomen, there are no interſtices among them, nor between them and the general covering of the belly; and conſequently they do not form (as they appear to do when diſſected) complete circles, but are flat towards the integuments, and flat too on their ſides, where they lie in contact with the next piece of gut.

Sometimes among the inteſtines (as in hernia), inflammation or ſuffuſion of blood may be miſtaken for mortification; but a dark lividity and tenderneſs of the inteſtines is the only unequivocal teſt of mortification. The effect of violent inflammation upon the ſurfaces, in making them become rough, or forming new membranes or irregular flocculi, was formerly taken notice of. One caſe of a moſt extraordinary nature I have ſeen: It ſeemed to be the conſequence of inflammation of the peritoneal coat of the inteſtines, though probably it was a peculiar diſeaſe of the inteſtines;—a very vaſcular membrane, or entirely a new and numerous ſet of veſſels, was formed upon the ſurface of the inteſtines, which was likewiſe ſtudded with little opake white eminences, like puſtules, but hard and cheeſy. I have theſe inteſtines minutely injected, and the veſſels are moſt beautiful, running in radii, and in great profuſion, to thoſe little eminences.

Caſes of TYMPANITES ABDOMINALIS often admit of diſpute. Without denying the fact of air puffing up the belly, and being contained without the inteſtines, or in what is called the cavity of the abdomen, it may be obſerved, that this can happen only immediately before death—perhaps from gangrene of the inteſtines, and the conſequent eſcaping of air from them. But the accumulation of air found in the abdomen on diſſection is oftener generated by putrefaction after death; as in caſes of gangrene of the inteſtines from hernia, in mortification after wounds, in gangrene of the uterus; and even where there have been no ſuch immediate ſources of putrefaction, there is often, upon opening the belly, a very diſagreeable guſt of air. To this ſource may perhaps be referred many of the tympanitic caſes given by the older writers. Morgagni himſelf, upon many occaſions, is too apt to overlook the origin of this air, generated by putrefaction in the body, counting it as natural and exiſting in the living body, and as eſcaping from the blood, where it counteracts the preſſure of the atmoſphere. For inſtance, he enumerates, in the hiſtory of a diſſection, theſe appearances: The ſtomach and inteſtines were diſtended with air; the gaſtro-epiploic vein turgid with blood, which flowed out frothy when cut into;—there was a hernia with beginning gangrene and bloody ſerum in the cavity of the abdomen; the heart was large and flaccid, with black frothy blood in it; not a vein through the whole body but was diſtended with air and blood; the ſcrotum was puffed up with air, and was obſerved increaſing even during the diſſection, and the ſtench was ſo intolerable, that they were obliged to put a ſtop to the diſſection. Now, Morgagni's intention in giving this caſe is not to put his reader on his guard in caſes where the ſubject is ſo putrid, nor to caution him againſt aſcribing ſuch accumulations of air to any other cauſe but putrefaction; but it is to illuſtrate an opinion he entertained, that apoplexy was produced by air extricating itſelf from the blood, and ſtopping the circulation in the ſmall arteries of the brain.

The TYMPANITES INTESTINALIS, again, may be ſaid to be a common occurrence, the inteſtines being often amazingly diſtended. I have ſeen two turns of the colon filling the whole abdomen, and compreſſing the ſmall inteſtines, which were thickened, red, and fleſhy; the diſtended inteſtine white, and free from inflammation, without any obſtruction or apparent cauſe, but probably ſome loſs of tone in the inteſtine. In Haller's Book of Pathological Caſes, there is deſcribed a tympany of a peculiar kind (and ſimilar caſes are given by Morgagni, and in other collections); between the muſcular and external coat of the inteſtines the air had raiſed veſicles, which, when opened, ſtunk intolerably; and Haller ſuppoſes

this air to have been forced through the coat of the inteſtines, and only reſtrained by the peritoneal coat from forming a true tympanites abdominalis; but no membrane in the living body will allow air, or any fluid, to paſs through it; and the coats of the inteſtines muſt have been totally deſtroyed before they could have allowed air to eſcape through them. It will be obſerved, that it is only by the contraction of their own coats that air or fæces can be expelled from them into the cavity of the abdomen, and not by the elaſticity of the air contained in them; becauſe, when diſtended by the air, the inteſtines being in contact with the general covering of the belly, are ſupported by it, and were they like cobwebs they would never burſt. I ſuſpect that the air in the veſicles, in this caſe of Haller's alſo, was air generated by putrefaction; and ſuch veſicles are common on gangrenous ſurfaces.

Upon this ſubject, although of great importance, I have not allowed myſelf to be very minute, and have mentioned only a few caſes as illuſtrating the general principles of this part of Morbid Anatomy.

SECOND DISSECTION OF THE ABDOMINAL VISCERA.

After having carefully examined the natural ſituation of the viſcera, and conſidered thoſe varieties in their appearance which are likely to diſconcert the diſſector in inveſtigating morbid anatomy, the inteſtines are to be removed in that order which may illuſtrate and confirm the ideas already obtained.

But when the object is a knowledge of the blood veſſels of the viſcera, the injection muſt be made before the inteſtines are roughly handled, or the delicate membranes of the omentum torn. The ſyſtem of veſſels to be injected before it is poſſible to ſtudy the veſſels of the belly, is very extenſive. It includes the aortic ſyſtem, or arteries of the viſcera; the venous trunk of the body; the veins of the floating viſcera and porta; beſides the venæ hepaticæ, biliary ducts, &c.

INJECTION OF THE VESSELS OF THE ABDOMEN.

Injection of the arteries.—As the nearer the tube is to the parts to be minutely injected, the greater is the chance of a ſucceſsful injection; the tube ſhould, in the preſent inſtance, be inſerted into the aorta immediately above the diaphragm: or the aorta being tied at this point, the injection ſhould be made from the femoral or iliac arteries. If the injection be made from above, the thorax muſt be opened; in doing which, the margin of the ribs to which the diaphragm is attached ſhould be left entire. This ſaves the trouble of tying the phrenic arteries, which would be cut in ſeparating the diaphragm from the ribs. It will alſo be neceſſary upon the left ſide to cut the ribs nearer to the ſpine, that acceſs may be had to the aorta, which lies deep in the cheſt, upon the left ſide of the ſpine, flat and empty, and covered by the pleura. All the veſſels cut upon the edge of the abdominal integuments muſt alſo be tied, care being taken to include all the principal branches, as the epigaſtric artery. And if, at the ſame time, the thigh is not to be injected, the external iliac artery muſt be tied, and a cord drawn round the thigh; for, to inject the thigh minutely, from the aorta in the thorax, requires a force that may very probably burſt the

unſupported veſſels of the inteſtines or ſtomach *. The inteſtines ſhould be kept under warm water, or heated with ſponges. The ſtomach alſo and bladder ſhould be filled with warm water; and it ſhould be remembered, that if the ſtomach be once diſtended too far, it will never be made to aſſume any thing of a natural appearance again. The cœliac arteries are thoſe in which rupture is to be expected.

By this injection, all the arteries of the ſtomach and inteſtines, with the hepatic arteries, and thoſe of the pelvis and bladder will be filled, while, at the ſame time, the membranes will be minutely injected.

Injection of the veins.—The veins alſo muſt be injected before the inteſtines are unneceſſarily handled. There are no valves in the veins of the inteſtines. The liver may be injected from the ramifications of the veins in the meſentery; or the minute extremities in the inteſtines may be injected from the trunk of the porta. To find the porta as it enters the liver, the ſtomach ſhould be held down, and the ſmaller omentum cleared away from betwixt the ſtomach and liver. The vein is then found covered in part with cellular ſubſtance, running obliquely acroſs the ſpine, and parallel to the biliary duct. If uncertain of its ſituation, the ſubſtance of the liver may be preſſed gently with the hand, or the blood urged along the veins of the inteſtines, when the vena portæ will riſe from the confuſion a large dark blue vein.

If the veins of the inteſtines are to be injected, the tube may be inſerted into the trunk of the vena portæ near the liver, and pointed downwards. But to inject the whole ſyſtem of the vena portæ at once, a tube ſhould be introduced into the ilio-colic vein. This branch is eaſily found, as it has its name from being ſubſervient to the caput coli, and that part of the inteſtinum ileum which joins the colon, or the angle formed by the joining of the ileum and colon. It is only neceſſary, therefore, to fold back the ſmall inteſtines from the right os ilium, and to expoſe the caput coli, and follow up the veins till they have aſſumed a ſize large enough to admit the tube. After puncturing and introducing the tube, there ſhould alſo be a ligature upon the veſſel behind the tube, to prevent the injection from coming round and eſcaping. Before throwing in the injection, theſe veins ſhould be repeatedly ſyringed with warm water, eſpecially thoſe of the liver. In throwing in the minute injection, it may be made to run more minutely into the inteſtines (where alone it is needed) by preſſing gently upon the trunk of the vena portæ. The vena cava abdominalis, and the veins coming into it from the liver, may eaſily be injected by tying the cava above the diaphragm, cloſe to the right auricle, and injecting from the femoral or iliac veins.

DISSECTION.

The ſmall inteſtines are now to be taken away, by folding the colon again over the breaſt, and ſearching for the beginning of the jejunum, where the ſmall inteſtines come out from under the meſocolon, and where it is connected to the ſpine; then the inteſtine being tied here with a double ligature †, it ſhould be cut betwixt the ligatures, and the gut ſhould be ſeparated from the meſentery, from this point downwards, following the convolutions of the ſmall inteſtines, and leaving only a ſmall portion of the ileum attached to the caput coli.

The inteſtines will now take a very ſimple form; only the colon and rectum, and the ſtomach, lying

* By injecting from the thorax, much is ſacrificed to the arteries of the viſcera. When the thorax is not to be opened, the injection may be made from the femoral arteries, while the aorta is tied above the cœliac; but the injection always runs better from trunk to branch than in this retrograde courſe.

† An inteſtine to be cut, muſt, for cleanlineſs, be tied with a double ligature, ſo that when cut the two ends may be cloſe. In the ſame manner, when examining the diſeaſed inner coats of the inteſtines, or their contents, portions in different parts of the canal ſhould be taken out in this way, and ſlit up in a flat baſon; and being cleaned, the diſeaſed ſtate is better diſplayed when they are floated in water.

EXPLANATION OF PLATE III.

Fig. 1.—The colon, and contents of the pelvis, diſſected out of the body, and their arteries, diſplayed.—A, The ſuperior meſenteric artery, ariſing from the aorta—B B, The meſocolon—C, The inferior meſenteric artery—D, The branches of the ſuperior meſenteric artery, which ſupplied the ſmall inteſtines E E, The ilio-colic artery—F, The right colic artery—G, The median colic artery—H, The hœmorrhoidal artery—I, Branches going to ſupply the ſigmoid flexure of the colon—K, The lumbar arteries, going off from the aorta—L, Common iliac artery—M, Middle ſacral artery—N, External iliac—O, Iſchiadic arteries—P, Poſterior iliac—Q, The pudic artery. It is ſeen ſending off the middle hœmorrhoidal artery to the rectum; which, from its ſize, is more like its diſtribution in the female pelvis—R, Hypogaſtric artery. The ligament running up to S, ſhows the remains of the umbilical arteries——a a a, Arch of the colon—b, Sigmoid flexure of the colon—c, Caput coli—f, Rectum—g, Veins returning the blood from the penis—h, Proſtrate gland—i, Veſiculæ ſeminales—k, Vas deferens, with the ſpermatic artery ariſing from the aorta, joining it where it is turning over the pin.

Fig. 2.—A plan of the diſtribution of the cœliac artery, aſſiſting Plate IV.—A, Aorta—B, Upper meſenteric artery—1, Trunk of the cœliac—2, Splenic artery—3, Coronary artery of the ſtomach—4, Hepatic artery—5, Gaſtro-epiploic artery—6, Right hepatic branch—7, Left hepatic branch—8, Artery going to the gall-bladder—9, Pancreatico-duodenalis—14, Artery to the pancreas; and the twigs from the ſplenic artery may be ſeen coming from the under ſide of that artery—10, Vaſa brevia—11, The left gaſtro-epiploic artery—12, Its inoſculation with the coronary—13, Inoſculation betwixt the right coronary and pyloric artery—15, Two phrenic arteries, ariſing in one trunk from the cœliac.

Fig. 1.

Drawn by Charles Bell.

Engraved by R. Scott.

Fig. 2.

Chas. Bell fec.

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behind the colon, will be ſeen, and the duodenum coming from below it; and the courſe of the jejunum and ileum may be followed from the projecting portion of the duodenum along the edge of the meſentery, till the ſmall inteſtines end in the caput coli. Again, the circle of the colon is to be followed round from right to left, till, after forming the ſigmoid flexure, it terminates in the rectum. The ſmall inteſtines cut from the meſentery ſhould be preſerved for the examination of their coats and villi, and the diſſection of the blood veſſels may be conducted in this manner.

DISSECTION OF THE MESENTERIC ARTERIES.—The order of diſſection is unfortunately not that which may ſeem the moſt natural, counting from trunk to branch; for the arteries of the ſmall inteſtines muſt be diſplayed before there can be eaſy acceſs to thoſe of the ſtomach and liver. The colon ſhould be blown up, and kept forming a full arch; then the veſſels of the colon and of the rectum are to be diſſected, and thoſe of the meſentery, which lie in the middle. Theſe comprehend the diſtribution of the upper and lower meſenteric arteries.

The SUPERIOR MESENTERIC ARTERY (Plate III. A) ſupplies the ſmall inteſtines, which have been cut away; and the right ſide of the great gut, which remains. Its trunk is found coming out from under the meſocolon (B B), and ſtretching over the duodenum.

The INFERIOR MESENTERIC ARTERY (C) is much ſmaller in its trunk, and leſs extenſive in its diſtribution. It ſupplies the left ſide of the colon and the rectum; running down over the os ſacrum into the pelvis, from which the whole artery has got the name of hœmorrhoidal.

The diſſection is to be begun with the looſe meſentery, by diſſecting off the peritoneal coat and fat from the veſſels. Theſe arteries of the ſmall inteſtines (D) have no appropriated names, but compoſe one maſs of innumerable branches, forming, before they reach the ſmall inteſtines, frequent anaſtamoſes and arches, by which the capacity of the branches combined muſt be wonderfully increaſed in proportion to that of the ſingle trunk from which they ariſe.

From the UPPER MESENTERIC ARTERY, upon the right ſide, three branches are given off to the colon.

The ARTERIA ILIO-COLICA (E), whoſe ramifications connect the branches which go to the ſmall inteſtines, and thoſe which go to the colon. It runs down in a direction to the caput coli (e), and laſt turns of the ileum (c). Its branches upon the ſmall inteſtines inoſculate with thoſe branches of the ſuperior meſenteric, diſtributed to the ſmall inteſtines in general; and, upon the great inteſtine, it inoſculates with the ſecond colic branch of the ſuperior meſenteric artery; viz.

The COLICA DEXTRA (F), which will be found running from the root of the ſuperior meſenteric artery acroſs towards the right ſide of the colon, where it begins to riſe over the kidney *, inoſculating largely with the laſt branch downwards, and upwards with

The COLICA MEDIA (G).—This branch goes directly upwards from the trunk of the upper meſenteric artery, as it comes out under the meſocolon. After running a little way upon the meſocolon, it divides; and the diviſion going towards the right ſide, makes a large circle upon the extremity of the meſocolon, and forms a great inoſculation with the right colic artery; while the other diviſion, going towards the left ſide, makes ſuch another ſweep, and joins with the left colic artery (T), which is a branch from the lower meſenteric artery. Theſe two branches of the median colic artery give off numerous ramifications, which ſupply a great extent of the middle part of the colon.

The INFERIOR MESENTERIC (C).—The branches of the inferior meſenteric artery are eaſily found.—The diſſection may be made backwards, from the hœmorrhoidal artery lying upon the back part of the rectum (H). Proceeding up along the gut, numerous branches are found diſtributed to that part of the inteſtine which forms the ſigmoid flexure (I). Theſe are derived from the uppermoſt branch of the

* Let it be remembered, that the deſcription always refers to the diſſected body; and that the letters pointing out the parts upon the plates, are thrown in here only as aſſiſting the deſcription.

lower meſenteric; as it ſupplies the left ſide of the colon, is called the COLICA SINISTRA (T); and, communicating with the median colic branch of the upper meſenteric, completes a great circle of inoſculations, reaching all the length of the inteſtinal canal *.

OF THE ACCOMPANYING VEINS SEEN IN THIS VIEW OF THE INTESTINES.—The branches of the veins run here in company with the arteries, however different they may be in the direction of their trunks. Therefore the names and diſtribution of the one ſet of veſſels being known, the other muſt be known alſo;—for all veſſels ſhould be named from the parts to which they are diſtributed, and not from the trunks from which they are ſent off; their diſtribution being conſtant, their derivation irregular.

The veins, as ſeen in this view of the parts, preſerve a uniform courſe; their varieties conſiſting only in the direction of the trunks into which they are gathered to form the vena portæ.

Returning then upon the demonſtration of the arteries. The HOEMORRHOIDAL VEIN, riſing from the back of the rectum, may be eaſily found—the VENA COLICA SINISTRA, coming from the left part of the colon—the VENA COLICA MEDIA, following the artery of that name, and returning the blood from the arch of the colon—the VENA COLICA DEXTRA, towards the right ſide of the colon—and the VENA ILIOCOLICA, from the caput coli—then one great branch is ſeen promiſcuouſly divided among the ſmall inteſtines, and returning their blood to the vena portæ.

Theſe veins are further traced in the next view of the inteſtines.

THIRD DISSECTION OF THE ABDOMINAL VISCERA,

Containing the Diſſection of the Cæliac Artery,—of the Trunk of the Vena Portæ,—of the Arteries and Veins of the Stomach,—of the Liver, Gall-Ducts, and Pancreas.

SEPARATING the omentum from the colon, and leaving it connected with the ſtomach, cut away the great inteſtines. The rectum, as it deſcends into the pelvis, ſhould be allowed te remain; for it belongs to the demonſtration of the parts there.

There is now much difficult diſſection. The ſtomach will be ſeen lying under the projecting liver; the ſpleen towards the left end of the ſtomach; and the pancreas under it, lying directly acroſs the aorta, reaching from the ſpleen to the duodenum, and involved in much confuſion.

The cœliac artery ſupplies all theſe parts lying in this upper diviſion of the belly, above the meſocolon. It is the ſecond artery of the abdominal aorta, coming off at the point where the great artery ſeems extricating itſelf from the diaphragm. It comes directly out from the aorta; a ſhort trunk, quickly dividing into branches. (See Plan of the Cœliac Artery, Plate III. Fig. 2.)

* In the diſſection of the lower meſenteric artery, its root is found entangled by the nerves of the lower meſenteric plexus, formed by branches from the ſympathetic, by branches from the ſuperior meſenteric ganglion, and from the ganglions. The lower meſenteric plexus, ſurrounding the trunk of the artery, ſends branches out along the meſentery to the left ſide of the colon, and to the rectum.—I hope afterwards to have a better occaſion of regularly detailing theſe nerves, and tracing them from the neck and thorax.

EXPLANATION OF PLATE IV.

FIG. 1.—a a a, The liver in outline—b, The round ligament, which is the remains of the umbilical vein—c, The broad ligament of the liver—d d, The ſtomach diſtended, ſhowing the veſſels ramifying upon its ſurface—e, The duodenum.

In this view, the ſplenic vein is cut, to allow the diſtenſion of the ſtomach.—A marks the vein coming out from the ſpleen—at B, it is ſeen running towards the vena portæ—C, The trunk which returns the blood from the lower meſenteric artery—D, The trunk anſwering the diſtribution of the upper meſenteric artery—E, The trunk of the vena portæ, formed by the three branches B, C, D—F, Remains of the umbilical vein—G G, The cava abdominalis, running up behind the liver to receive the hepatic veins H H—I, The gall-bladder, with the cyſtic duct reaching down from it to join the hepatic duct K ——1, The trunk of the cœliac artery—2, The ſplenic branch—3, The ſuperior coronary artery—4, The hepatic artery—5, The gaſtro-epiploic artery—6, The right hepatic artery, ſending off the cyſtic branch —7, The left hepatic artery, ſending off the pyloric artery 8—g, The ſpleen.

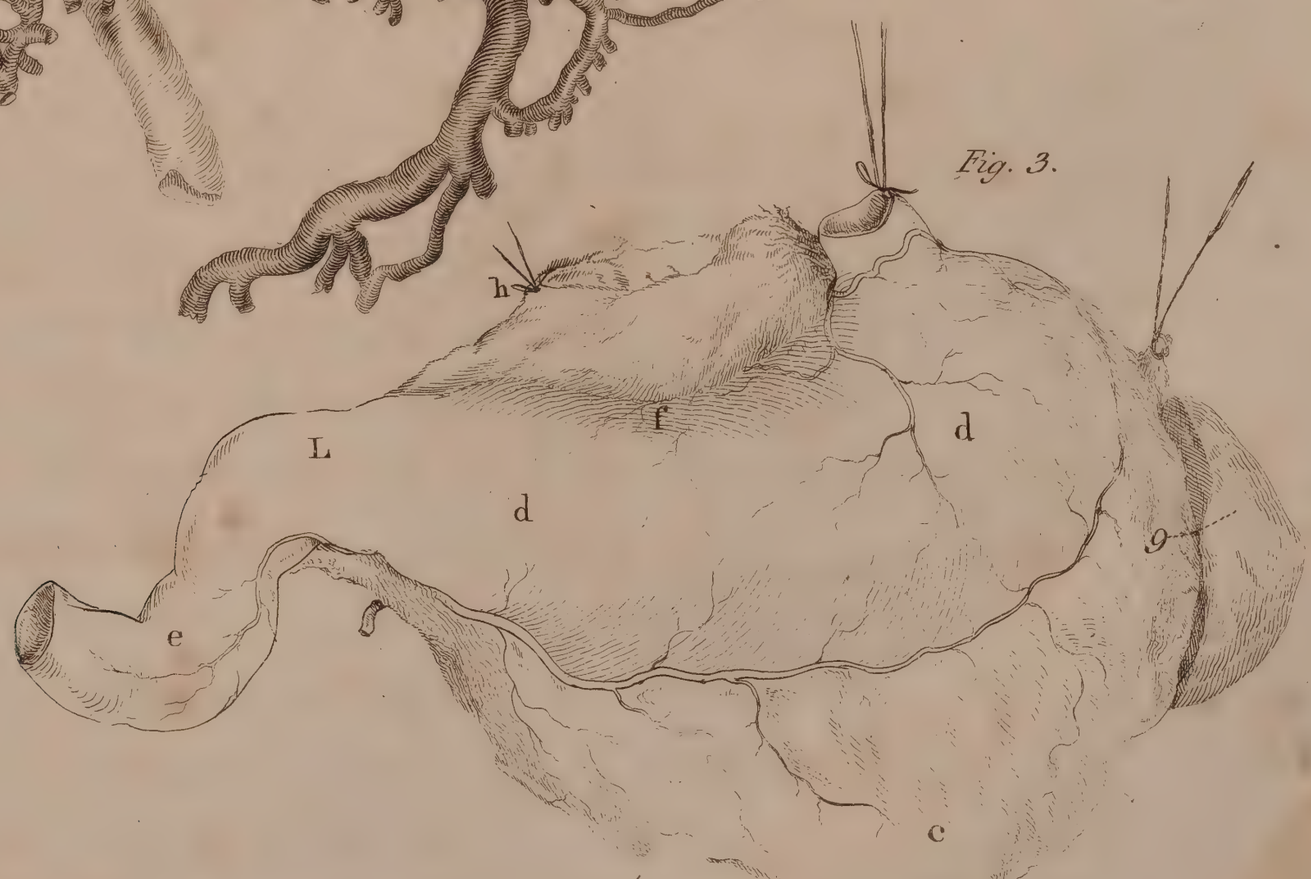
FIG. 2.—The gall-ducts and pancreas.—I, The gall-bladder—K, The hepatic duct—L, The cyſtic duct—M, An acute turn of the cyſtic duct, reflected upon the gall-bladder—N, The common duct—O, A ſtone in the hepatic duct—P, The pancreas, ſeen upon its under ſide—Q, Part of the duodenum.

FIG. 3.—The ſtomach, with the omentum and ſpleen.—d d, The ſtomach—c, The omentum—e, The duodenum—L, The pyloric orifice—h, The cardiac orifice—f, The leſſer curvature of the ſtomach, with the little omentum attached to it—9, The ſpleen.

Fig. 1.

Fig. 2.

Fig. 3.



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The beſt way to diſſect this artery is to lay down the ſtomach (as in Plate IV. Fig. 1.); and to diſſect away the leſſer omentum from betwixt the liver and ſtomach. The cœliac artery (Plate IV. Fig. 1. 1, and Plate III. Fig. 2. 1) is then found, dividing at once into many branches; and as they depart in different directions from one point, as from a centre, this is called the AXIS ARTERIÆ COELIACÆ.

The ARTERIA CORONARIA VENTRICULI will be found going off towards the left ſide (Plate III. Fig. 2. and Plate IV. Fig 1. 3), and ſpreading largely over the upper part of the ſtomach. If, in diſſecting it where it goes off from the trunk of the cœliac, it is found to be larger than the other branches, then it may be expected to ſend a branch to the liver, and ſhould be more cautiouſly diſſected in that direction; viz. a little to the left, and then upwards, till it be loſt in the FOSSA DUCTUS VENOSI of the liver. When there is no branch ſent to the liver, it holds its courſe to the left or ſuperior orifice of the ſtomach. Here it divides into two branches; one of which encircles the cardiac orifice, and inoſculates with the gaſtro-epiploic artery above the ſpleen; the other runs down the leſſer arch of the ſtomach, ſends a branch over the broad ſide of the ſtomach, and, continuing its courſe, inoſculates with the pylorica, or coronaria dextra. (See Plan of the Cœliac Artery, Plate III. Fig. 2. 13). In tracing theſe branches upon the leſſer curvature of the ſtomach, they will be found complicated with the branches of the eighth pair of nerves, or PAR VAGUM, diſtributed to the ſtomach.

The ARTERIA SPLENICA (Plate III. Fig. 2. 2, Plate IV. Fig. 1. 2) ariſes from the trunk, or axis of the cœliac (1). It paſſes under the ſtomach, and along the borders of the pancreas, where it gives off the PANCREATICÆ PARVULÆ. Continuing its ſerpentine courſe, it gives the VASA BREVIA (10) to the ſtomach, and ſmall branches to the meſocolon. When it reaches the ſpleen (Plate IV. Fig. 1. g), it makes a curve in its boſom, and enters it in ſeveral branches. It ſends off from its branches in the ſpleen, a more conſiderable branch (11) to the ſtomach; which, inoſculating with the gaſtro-epiploic artery (5), is called the GASTRO-EPIPLOICA SINISTRA.—The artery of the ſpleen is tortuous; probably to allow the dilatation of the ſtomach: For it is not the force of the blood in the artery which curves it, or makes it tortuous; nor does this ſeem a proviſion for breaking the force of the blood, as the vein alſo is tortuous.

The ARTERIA HEPATICA (Plate IV. Fig. 1. 4, and Plate III. Fig. 2. 4) runs in a direction oppoſite to the ſplenic, towards the right ſide. After having run ſome way in the direction of the trunk of the vena portæ, it divides, nearly at the ſame place, into four important branches, ſpreading over the trunk of the vena portæ.

BRANCHES OF THE HEPATICA.—Firſt, There is ſent off the ARTERIA GASTRO-EPIPLOICA (5), ſo named from its chief branch; or ſometimes called the DUODENO-GASTRICA, from that branch of it (Plate III. Fig. 2. 9) which goes to the duodenum. This artery, deſcending under the pylorus to gain the great curvature of the ſtomach, with its accompanying vein, it catches the eye, while the viſcera are yet entire. It is ſeen beautifully diſtributed to the ſtomach and omentum; and reaching the left and obtuſe end of the ſtomach, it inoſculates largely (11) with the ſplenic artery. As this gaſtro-epiploic artery runs acroſs the under ſide of the duodenum, the PANCREATICO-DUODENALIS (See Plate III. Fig. 2. 9) is ſent off. It runs down the inteſtine, and ſends a conſiderable branch (14) alongſt the pancreas.

The hepatic artery (Plate III. Fig. 2. 4), after ſending off this branch, almoſt immediately divides into the right and left hepatic branches: And from the left branch is ſent off the CORONARIA DEXTRA (Plate IV. Fig. 1. 8); which, turning backwards, ſpreads its branches upon the pyloric end of the ſtomach, inoſculating with the proper coronary of the ſuperior orifice, and with the pyloric arteries, which are numerous and important twigs from the ſurrounding greater arteries. This artery ſometimes comes off from the trunk of the hepatic artery (as in the Plan of the Cœliac, Plate III. Fig. 2.). The left hepatic artery (Plate III. Fig. 2. 7, and Plate IV. Fig. 1. 7), climbing upon the vena portæ, enters the liver, and, ſeparating into branches, continues attached to the great vein, and is diſtributed within the liver to

the whole of the left lobe, the lobe of Spigelius, and part of the right lobe. The right hepatic branch (Plate IV. Fig. 1. 6, and Plate III. Fig. 2. 6), paſſing under the hepatic duct of the liver (k), is diſtributed to the right lobe of the liver and the gall-bladder.

In diſſecting the root of the cœliac artery and the aorta, betwixt it and the ſuperior meſenteric artery much confuſion ariſes, from the meſhes of the ſemilunar ganglion, and the branches coming to it from the anterior branch of the ſympathetic nerve, and from the eighth pair upon the ſtomach. From this ganglion an immenſe number of ſmaller nerves are ſent out, forming leſſer ganglions, along the meſentery, to the duodenum, jejunum, ileum, and great part of the colon, and to the liver.

To trace the nerves through the confuſion of the viſcera, is, perhaps, the moſt difficult diſſection of any; for their minute branches being white, and like the fibres of the ſurrounding parts, it is difficult to trace them. In the ſituation of the parts, as deſcribed in this diſſection, only the nerves of the ſtomach and liver can be conveniently ſeen; for the ſemilunar ganglion is very extenſive and irregular, being divided into ten leſſer cœliac ganglions, covering the aorta and roots of the cœliac and upper meſenteric arteries, and ſpreading on each ſide of the aorta upon the diaphragm, and ſending out delicate branches on all ſides.

The cœliac ganglion, upon the left ſide, may be better diſſected by turning the ſtomach and ſpleen from their ſeat, holding them towards the right ſide. Then the branches are ſeen diſtributed to the kidney, and to the ſpleen, alongſt its veſſels, in looſe branches.

Of the vena portæ.—The vena portæ is formed by the gathering together of the veins from the inteſtinal canal, and from the ſpleen and pancreas of the ſolid viſcera. Near the liver theſe are collected from three great branches, anſwering to the cœliac, upper and lower meſenteric arteries. The trunk of the vena portæ (Plate IV. Fig. 1. E) lies obliquely acroſs the ſpine. The branch anſwering to the cœliac, is the ſplenic vein (B). It forms one of the great arms of the vena portæ in the belly; it is carried in the direction of the main trunk; it gathers the blood from the ſpleen, ſtomach, pancreas, and omentum.

The veins coming up from the lower part of the belly, anſwering to the meſenteric arteries, are the meſenterica major (D), and the meſenterica minor (C). All the veins from the meſentery, and from one half of the colon, meeting together, form the firſt of theſe; which, from its ſize, is the moſt important vein of the inteſtines. Its branches run in company with the extremities of the ſuperior meſenteric artery, as they are ſpread from the duodenum, along the tract of the inteſtines, to the middle of the colon. It joins the trunk of the vena portæ.

The vena meſenterica minor (C) carries back the blood from the left ſide of the colon, and from the rectum, accompanying the lower meſenteric artery in its whole courſe; and from the branch which mounts up upon the back of the rectum, it has been called the hœmorrhoidea interna. This vein joins ſometimes with the ſplenica (B), more commonly with the meſenterica major (D). As the great meſenteric vein goes up under the duodenum, it receives the veins of the pyloric orifice, and thoſe anſwering to the pancreatico-duodenal artery: and as the trunk of the vena portæ runs acroſs the ſpine towards the liver, it receives the veins from the right ſide of the duodenum, and leſſer arch of the ſtomach, anſwering to the leſſer coronary, or right coronary of the ſtomach; then mounting obliquely upwards, and towards the right ſide, it enters the porta of the liver, and dividing at E into two great branches, forms the great ſinus of the liver.

In diſſecting theſe veins, there is much cellular ſubſtance to be cleared away; and it is not eaſy, if the injection be at all brittle, to diſſect upon their thin coats, without cutting them, or breaking the injection.

As the vena portæ approaches the liver, it runs parallel to the ducts and the hepatic artery. They are

here included in one ſheath of cellular ſubſtance, viz. the capſula gliſſonii. This was formerly thought to aſſiſt the circulation of the blood in the liver, by giving a pulſation to the vena portæ; which was in all probability ſuggeſted, by obſerving the pulſation of the hepatic artery within this covering, in opening living animals.

The vena portæ, then, is a vein performing the office of an artery in the liver, by diſtributing in it that blood which it collects from the arteries of the inteſtines. But the proper veins of the liver, the branches of the vena cava hepatica, return their blood directly to the heart. Theſe, in their extremities (Plate IV. Fig. 1. H H), are diſtributed much like the vena portæ; but upon diſſecting the under ſurface of the liver, they are found, when gathered into trunks, to turn away from the porta, and run up towards the attachment of the liver to the diaphragm, and enter into the inferior cava very near the heart.

The lymphatics can be nowhere ſo eaſily found as upon the ſurface of the liver (where they reſemble the traces left by ſteam condenſed and trickling down an inclined ſurface), or in the cellular ſubſtance accompanying the great veſſels of the liver, or on the gall-bladder and ducts.

The gall-bladder (Plate IV. Fig. 1. I) will be found on the under ſurface of the liver, half ſunk into the ſubſtance of the gland; and when the liver is in its place, it is nearly horizontal. It is touched by the duodenum and colon, as the tinging of the bile in bodies opened ſome time after death, demonſtrates. There are often adheſions betwixt the gall-bladder and colon. The gall-bladder is ſometimes greatly increaſed in ſize; yet the quantity of bile contained in the bladder is nothing to what is ſuddenly vomited in ſome diſeaſes.—The hepatic biliary duct (Plate IV. Fig. 1. and Fig. 2. K) comes from the ſubſtance of the liver; runs by the ſide of the great veſſels; and is large, compared with the cyſtic duct (Fig. 2. L), which does not come off directly from the gall-bladder, but turns up a little upon its ſmaller end (at M), before it deſcends to meet the other duct, which it does at an acute angle. They run ſome way together before they join to form the ductus communis choledochus (Fig. 4. N). This common duct, ſeparating from the vena portæ, runs down, obſcured by the pancreas, behind the duodenum, and betwixt the lamina of the meſocolon; then entering the coats of the duodenum, it runs ſome way betwixt them before it opens into the cavity of the gut*; it generally enters by the ſame mouth by which the duct of the pancreas enters, although ſometimes they enter ſeparately. The gall-bladder and ducts may be injected from the common duct, or the bladder; and all the ducts may be filled, by introducing the pipe into the bladder behind, ſo as not to injure the appearance of the preparation. The nerves of the liver are very minute, anſwering to its inſenſibility; though ſuch correſpondence, by no means, holds uniformly. They come from the eighth pair, and great ſympathetic, running in two diviſions, with the hepatic artery before, and with the vena portæ behind. There are likewiſe ſome twigs from the anterior plexus of the ſtomach.

As the opening of the common duct (Fig. 2. N) into the inteſtine is apparently the eaſier paſſage, how is the bile collected in the cyſt? The uſe which is naturally ſuggeſted to us, is, to prevent the perpetual diſcharge of the bile into the inteſtine, and to reſerve it to be mixed with the food as it paſſes the duodenum. But it is not eaſy to determine how this is done;—whether by the diſtenſion of the inteſtine, and conſequent preſſure upon the gall-bladder; or by the contraction of the gut, and conſequent opening of the mouth of the duct;—or whether it be not an irritation of the mouths of the ducts themſelves, by which the diſcharge into the inteſtine is regulated, and even the ſecretion promoted. A calculus in the common duct muſt, if not diſcharged, diſorder the whole ſyſtem; but the cyſtic duct being ſmaller and more valvular, concretions formed in the bladder, if they paſs the cyſtic duct, can generally paſs the common duct. When there are calculi in the hepatic duct (as repreſented in Plate IV. Fig. 2. o), the

* To underſtand the valve of the lower orifice, and the entrance of the biliary and pancreatic ducts, open the duodenum, and examine it in water.

ducts which ramify in the liver muſt be enlarged; while the ducts below (k) muſt ſhrink, and even the bladder (I) and cyſtic duct (L) muſt ſhrink.—Pain in the ſtomach may ſometimes be confounded with pain in theſe ducts, perhaps from the paſſage of a gall-ſtone. But ſome judgment may be formed from which of theſe the pain proceeds, conſidering the ſituation of the ducts, and remembering that pain in the ducts is confined more to a fixed ſpot; while the gaſtrodynia is more diffuſed, and the pulſe weaker, with general debility. When the cyſtic duct is obſtructed, then the gall-bladder ſhrinks; and when the common duct, then it is enlarged. There are caſes of calculi making their way out by the umbilicus, and leaving a little ulcer, diſcharging a yellow lymph. This happens by the enlargement of the gall-bladder, and its adheſion to the integuments. In the *Memoires de Chirurgie*, a caſe is given by Petit; who was ſo bold as to operate upon a circumſcribed tumor, preſenting at this place; from which he extracted a calculus, and relieved his patient from extreme agony. But for the moſt part, thoſe extraordinary caſes, of knives cut from the ſtomach, and bodkins from the groin, and ſtones from the gall-bladder, which at firſt ſeem impoſſible, are but the opening of a ſuperficial abſceſs, where the foreign ſubſtance, having gradually made its way outwardly, is almoſt protruding; and it is only in ſuch a ſtate of the parts that the operation can be performed.

There are ſeveral inſtances of worms getting into theſe ducts from the inteſtines, and even neſtling and adhering in groupes.

PECULIARITIES IN THE SITUATION OF THE VESSELS OF THE ABDOMEN.

The vena portæ, which receives the blood from the arteries of the abdominal viſcera, is like the other veins of the body, comparatively of a larger ſize, and thinner in its coats, than the arteries. It gathers its branches into one great truuk: but when it has arrived in the liver, though it retains the character of a vein in the thinneſs and inactivity of its coats, yet it aſſumes the office of an artery; for it again divides into branches; and its blood does not flow from its extremities towards its trunk, but, like that of an artery, from the trunk towards the extremities.

To account for this further propulſion of the blood, the muſcularity of the coats of the vein, and the alternate action of the abdominal muſcles, is ſuggeſted in almoſt every book. But the coats of a veſſel, though endowed with muſcular power, can give no aſſiſtance in propelling the contained fluids, unleſs an alternate action be allowed. Now the veins having no pulſation, their muſcular fibres contract their diameter only till the force of contraction is equally oppoſed by the force of the circulating blood; and they then become like rigid tubes. If, therefore, the muſcular fibres of the veins are proved to exiſt, and ſuppoſed to accelerate the blood, a pulſation muſt be allowed alſo. Ingenious men may perplex even the plaineſt truths; but that the veins have no pulſation cannot be long a queſtion, when the action of the heart and veſſels is attended to. The uniform flow of blood in the veins is generally accounted for, from the ſuppoſed effect of the blood in a vein receiving the impulſe of the heart by channels of unequal lengths. But, though this may account for it, perhaps a ſtill more ſatisfactory reaſon may be drawn from conſidering the conſequence of the action of the two accelerating powers, the heart and arteries. The pulſation of the heart, by a gradation of forces, which it would be tedious to explain, is continued into the extremities of the veins. This is a fact acknowledged by all who wonder how the veins, like the arteries, do not anſwer to the ſtroke of the heart. The blood is carried forward to the beginning of the veins by the contraction of the heart, at the ſame time that the arteries are dilating; and the arteries

being dilated, they immediately contract, and puſh their blood into the veins, which, alternating with the contraction of the heart, cauſes not an interrupted ſtream or pulſation, but a continued flow. The arteries beat, becauſe they receive a pulſation from the heart's contraction; but the veins, being beyond the arteries, receive the force of contraction both of the heart and arteries; and theſe, ſucceeding each other without interval, make a continued ſtream in the veins. To uſe a familiar example, they are in the ſituation of the nozle of a double bellows.

If it were aſked of thoſe who ſay that reſpiration mechanically aſſiſts the circulation of the blood in the abdomen, whether theſe veins are more compreſſed during the contraction of the abdominal muſcles, or during that of the diaphragm? they would heſitate; for there have been no experiments to aſcertain whether the preſſure upon the abdominal viſcera be uniform or not. And ſurely, from conſidering the alternate action of the diaphragm and abdominal muſcles, the one receding while the other acts, we muſt conclude that there is an uninterrupted preſſure: and before it can be ſaid that even the violent efforts of vomiting and coughing compreſs the abdominal veins, or accelerate their blood, the ſtate of the thorax in the ſame actions muſt be conſidered, and whether the preſſure there be not equal to that in the abdomen. (See veins at the groin and at the heart.) That a degree of preſſure kept upon theſe veins by the abdominal muſcles and diaphragm, is neceſſary, we know, from an old obſervation of Bartholine, confirmed every day, that, upon opening the belly of a living dog, he obſerved the veins gradually ſwell, and become monſtrouſly diſtended. There are frequent opportunities of obſerving, in the human body, the conſequence of this tenſion being taken off; as in the evacuation of the waters in dropſy and in child-birth, and even in the ſudden diſcharge of wind from the inteſtines. In ſlighter caſes, it is attended by a peculiar faintiſh feeling. Sometimes it proves fatal. In one caſe, recorded by the younger Du Verney, the operator, miſtaking for dropſy a habitual diſtenſion of the inteſtines with air, puſhed his trochar into their cavity: the air ruſhed ſuddenly out, the abdomen became flaccid, and the patient died in a very ſhort time. There are other caſes, where the patient being waſted and feeble, a ſudden diſcharge of wind by ſtool has occaſioned ſudden death.

FOURTH DISSECTION OF THE ABDOMEN.

The cavity of the abdomen ſhould now be freed from all the complication of the viſcera. But ſtill a tedious diſſection is required to ſhow the muſcular and tendinous parts of the DIAPHRAGM,—the paſſages for the VENA CAVA, the OESOPHAGUS, and AORTA—to diſplay the MUSCLES OF THE LOINS,—the KIDNEYS and URETERS,—the VENA CAVA, and the general diſtribution of the AORTA.

The DIAPHRAGM is the ſeptum which divides the thorax from the abdomen. It ariſes muſcular from the borders of the cheſt, and tendinous from the vertebræ of the loins. But it has no inſertion; its action is within itſelf; it moves no parts, as other muſcles do, but, by its contraction, alters its own convexity. Before opening the thorax, it may be ſeen how the middle part of the diaphragm is retired up into the thorax, forming a large concavity, which receives much of the abdominal contents; and how it is ſucked up, and made tenſe, by a vacuum in the thorax. In this ſtate, if the thorax be opened or

punctured, the diaphragm is seen to fall flaccid and loose. Observing this, the effect of the action of this muscle must be easily understood: that, by the contraction of its muscular part, the arch which it forms into the thorax approaches to a plane, dividing the two cavities, and consequently enlarging the capacity of the thorax, and allowing the lungs to receive the atmospheric air. The great muscle of the diaphragm, as it arises from the borders of the chest on the inside, should be first dissected. This extensive origine is to be followed round to the false ribs, and where it approaches the spine, a kind of ligament is found passing from the twelfth rib to the vertebræ, forming an arch over the upper part of the psoas magnus. This, the LIGAMENTUM ARCUATUM, will probably be found difficult to demonstrate satisfactorily; for the fibres of the diaphragm here are strong, yet loose and flabby, and not easily dissected, as it lies under the kidney, and under much loose cellular substance, and soon spoils. Down upon the spine, an irregular sheath of tendons will be found, lying flat and silvery, and arising from the ligaments of the lumbar vertebræ. These origines, or feet of the crura of the diaphragm, may be counted: but it is more important to observe the muscle connected with these tendons, viz. the SMALLER and POSTERIOR muscle of the diaphragm; and how these crura stretch over the aorta, and surround it; while, by the direction of their fibres, they are prevented from compressing the great artery. These muscular fibres, after passing the aorta, mingle; but they again separate to give passage to the œsophagus, and again intersect each other above the œsophagus.—The central tendon is the tendon of this great circle of muscle. The fibres composing it are intricate, and form irregular interlacements, which yet keep a wonderful similarity in different subjects. Through this central tendon the vena cava pierces, to go up into the thorax. Here there are no muscular fibres, the passage being large and free.

The fleshy muscle filling up the space at the side of the spine, is the PSOAS MAGNUS. It is very strong, supporting the trunk upon the lower extremity, and moving the thigh upon the pelvis. Its uppermost origine is from the last vertebra of the back; at which place it is covered by the diaphragm: from this point downwards to the sacrum, it arises from the transverse processes and sides of the vertebræ; which origines are concealed by its belly. It runs under Paupart's ligament out of the belly, and turns over the head of the thigh bone to be inserted into the lesser trochanter of that bone.—The tendon of the psoas parvus will be found running down on the inside of the belly of the great muscle. The iliacus internus, filling up the cup of the ala ilium, may be dissected at the same time, as it accompanies the psoas, and has the same insertion.

To follow these at present to their insertion, would be encroaching too much upon the dissection of the thigh.

To dissect the great vessels of the belly, when injected, is no very difficult matter; for it is but cleaning away the cellular substance from them. It may be observed how the aorta comes out under the diaphragm. It enters the abdomen upon the left side of the spine; but proceeding downwards, it shifts more towards the middle of the spine.

The vena cava in the upper part of the belly, as in the breast, does not lie close to the back-bone; but proceeds from below upwards, upon a higher level, towards the perforation of the diaphragm.

The abdominal branches of the aorta may now be enumerated. 1. The phrenic arteries, sent off as it passes under the diaphragm, or perhaps from the cœliac artery, (as in the Plan, Plate III. Fig. 2.): 2. The cœliac artery, sent off to the stomach, liver, and spleen: 3. The superior mesenteric artery: 4. The emulgents, one sent off on each side to the kidneys: 5. The lower mesenteric artery.

Besides these, the aorta gives off the lumbar arteries, which are seen dipping under the psoas magnus of each side. As the emulgent arteries go off from the aorta betwixt the superior and inferior mesenteric arteries, it happens that all the great arteries of the viscera are sent out within a very small space; and at this point aneurisms of the abdominal aorta are most frequently found.

Before the emulgent arteries enter the kidneys, they give off small branches to the glandula atrabila-

ria (which are ſmall triangular bodies, ſeated like a cape upon the upper end of the kidney, and which dwindle in the adult), and alſo to the fat ſurrounding the kidney. The parts ſurrounding the kidney likewiſe receive arteries from other ſources, even from the phrenic arteries; and beſides, each of the ſmall glands attached to the kidney has an artery, peculiarly its own, coming from the aorta, at the root of the upper meſenteric artery. On the fore part of the aorta will be found ſmall twigs, running to ſupply the lumbar glands. But the arteries which there is moſt danger of deſtroying, are the SPERMATIC ARTERIES, which are extremely ſmall, running down parallel to the aorta. The left ſpermatic artery comes more frequently from the emulgent artery than from the ſide of the aorta; the right more generally from the ſide of the aorta. The artery of each ſide, running down along the pſoas muſcle, is joined by its accompanying vein from the emulgent or renal veins: then deſcending, it courſes round the brim of the pelvis to the abdominal ring, where it meets the vas deferens as it is about to drop down into the pelvis to join the veſiculæ ſeminales upon the neck of the bladder.—The emulgent, and conſequently the ſpermatic, veins do not empty themſelves, like the veins of the other abdominal viſcera, into the vena portæ, but into the vena cava inferior: ſo do all the veins of the ſolid walls of the abdomen. The ſpermatic veins are the only veſſels within the abdomen having valves, which ſhows a ſtrange proviſion for their deſcent out of the abdomen into the ſcrotum.

To deſcribe, in this diſſection, the nerves which muſt be cut; how the anterior crural nerve is compoſed; the connections of the intercoſtal nerve; and the numerous and intricate branches going to the muſcles of the loins and belly, would lead to a long, and, I truſt, ſuperfluous diſcuſſion; ſince they muſt be regularly detailed in the other Numbers, whilſt this has been carried beyond its due length.—It may, however, be remembered, that to diſſect theſe nerves completely, ſo as to have a comprehenſive view of them, the ribs of one ſide muſt be cut far down, the diaphragm ſeparated from the margin of the ribs on the ſame ſide, while it is kept attached at its tendinous origines from the lumbar vertebræ, and held out ſo that the ſide of the ſpine may be ſeen in the thorax, and down to the pelvis: then the kidney being lifted from its ſeat, let it be held out, attached only by the ureters and emulgent veſſels. In this ſituation of the parts, the ſympathetic, and its connections with the ſpinal nerves, may be diſſected in the thorax, above the diaphragm; and the anterior branch, ſent off in the thorax, can be traced through the diaphragm to the ganglions about the root of the cœliac artery; and the continuation of the ſympathetic nerve may be ſeen running, near the root of the ribs, down the ſpine. As the ſympathetic deſcends, it comes more towards the fore part of the bodies of the vertebræ: here it receives additions from each lumbar ganglion, and ſends at the ſame time numerous ſmall branches over the great veſſels, and finally ends in the numerous and delicate plexus within the pelvis.

A

SYSTEM

OF

DISSECTIONS.

PART II.

CONTAINING

THE ANATOMY AND DISEASES

OF THE

THORAX.

WITH PLATES.

BY CHARLES BELL.

EDINBURGH.

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1798.

A

SYSTEM

OF

DISSECTIONS.

DISSECTIONS

OF THE

THORAX.

KEEPING in view the general plan which was at firſt laid down, the preſent ſubject ſhall be divided in ſuch a way, that each branch of it may be comprehended in one diſſection, or view of the parts, as they lie in the dead body: And thoſe points of the anatomy ſhall be chiefly dwelt upon which are uſeful in diſſection, or in underſtanding the local or organic diſeaſes.—The firſt diſſection of the thorax naturally includes the muſcles and blood-veſſels which lie upon the breaſt and lower part of the neck;—then, proceeding to the viſcera, the appearance of the heart, lungs, and mediaſtinum, upon lifting the ſternum, makes the ſecond diviſion;—next the manner of diſplaying the heart is to be explained;—afterwards the injection of the heart, with the diſſection of the great veſſels proceeding from it;—and the diſſection of the nerves of the neck and of the thorax cloſes theſe ſeveral views of the anatomy of the thorax.—Laſtly, the morbid anatomy of the breaſt will ſolicit attention: firſt, aneuriſms, and the diſeaſes of the heart and larger veſſels, with the circumſtances which are to be obſerved in the diſſection of thoſe diſeaſes;—and, ſecondly, the diſeaſed appearances of the lungs, of the pleura, and of the cavity of the cheſt in general.

It may, however, be proper further to obſerve in this place, that in explaining the ſituation of the heart and great veſſels, and the play of the lungs, it is impoſſible to overlook the deficiencies in the accounts that are given of the mechanical action of the heart and vaſcular ſyſtem, and of the effect of reſpiration, upon the action of the heart, or rather of the manner in which its effect upon the heart and veins is counteracted. And it ſurely will not be thought too great a departure from the plan and limits of this book, to touch ſlightly upon theſe important points;—they are points ſuſceptible of ſuch clear explanation, that they muſt be conſidered rather as hitherto neglected than as miſunderſtood.

FIRST DISSECTION OF THE THORAX.

The Diſſection of the Muſcles and Blood-veſſels which lie upon the outſide of the Cheſt and lower part of the Neck.

NOTHING confounds a perſon more in diſſection than an ignorance of the parts which immediately ſurround that upon which he is employed: therefore, in explaining the diſſections of the outſide of the cheſt, it is proper to point out, not only the muſcles, and the branches of arteries which lie upon the cheſt, but thoſe likewiſe which lie in the axilla, and upon the neck, as being ſtrictly connected with them in every uſeful inference to be drawn from the anatomy of this part.

To follow the diſſection as repreſented in Plate V. (which is ſcrupulouſly drawn from the ſubject), make an inciſion from the thyroid cartilage down the middle of the ſternum, and extending below the ſcorbiculus cordis; then make an inciſion in the direction of the clavicle, and over the top of the left ſhoulder. In diſſecting the integuments of the breaſt, carry the knife in the direction of the laſt inciſion; by which the pectoralis major muſcle (a b c), and the deltoid muſcle (d), will be ſmoothly diſſected in the direction of their fibres.

No faſcia will be found expanded over the muſcles which lie upon the cheſt; but the fibres of the muſcles are ſeparated from the fat lying under the ſkin by a thin aponeuroſis of an opaque and milky whiteneſs; which adheres cloſely to them, and is not eaſily diſſected away, unleſs very regularly done, as the diſſection of every muſcular part ought to be. The PECTORALIS MAJOR ariſes from the fore part of the clavicle (e), from the ſternum (c c), and from the cartilaginous endings of the fifth and ſixth ribs (b f). From the origins of ſuch extenſive flat muſcles as this, the fibres are generally prolonged into faſciæ, ſcarcely diſtinguiſhable from the common membrane. Of this kind are the fibres which ſtretch acroſs the ſternum from one pectoral muſcle to the other, and are connected to the periſternum. So conſiderable is the membrane reſulting from the extended margins of the PECTORAL MUSCLE (b f), the SERRATUS ANTICUS (g g g), the RECTUS (h), and OBLIQUUS ABDOMINIS (i i)—that they may all be lifted at once from the ribs, and yet be preſerved attached to each other. In Plate V. are repreſented the indigitations of theſe muſcles; and the fibres are not marked more diſtinctly than they appeared in the ſubject; nor does the drawing in any reſpect deviate from the truth of nature. A ſlip (b), taking its origin from the ſixth rib, goes up to the pectoral muſcle. The fibres of the pectoral muſcle (a k) are ſeen converging to form the tendon, by which, turning round into the axilla, it is inſerted into the arm-bone. It will be obſerved, that the upper portion of the muſcle, ariſing from the clavicle (e a), deſcends, in a direct line, to its inſertion at (l); while that portion of the muſcle which comes from the lower part of the breaſt (k) twiſts as it goes round into the axilla, and is inſerted into the arm-bone, nearer its head than the part of the tendon at (l), anſwering to the upper margin of the muſcle (a).

The origins of the OBLIQUUS DESCENDENS ABDOMINIS are marked (i i i).—The SERRATUS MAJOR ANTICUS (g g g), is laid like a hand broad upon the cheſt, with its digitations extending upon the ribs. It is thin and flat where it ariſes by its ſerrated origins (from all the true ribs except the firſt, and from three of the falſe ones): but as it retires under the latiſſimus dorſi (m), its fibres converging, it acquires a conſiderable thickneſs. It is inſerted into the backmoſt edge or baſe of the ſcapula.

For the origins of the OBLIQUUS DESCENDENS ABDOMINIS (i i), and of the RECTUS (h), ſee the diſſection of theſe muſcles, page 1 and 2. The DELTOID MUSCLE (d d) covers the ſhoulder-joint

Drawn by Chas Bell

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with a fleſhy cuſhion. It is naturally divided into three portions by cellular membrane and fat: one diviſion comes from the clavicle; another from the acromion proceſs of the ſcapula; a third from the ſpine of the ſcapula. It is inſerted by a ſhort tendon, encircling the arm-bone about one-half of its length from the head.

Of the BLOOD-VESSELS CONNECTED with the DISSECTION of these MUSCLES.

Betwixt the deltoid and pectoral muſcles there is found cellular membrane and fat; and from the upper part of this interſtice, and near the clavicle, a conſiderable branch of an artery (1) comes up from the ſubclavian artery, and is diſtributed over the ſhoulder and upper part of the pectoral muſcle. This is the RAMUS SUPERFICIALIS ARTERIÆ THORACICÆ ACROMIALIS of Haller; or a branch of the third thoracic artery, as commonly enumerated. If this branch be diſſected towards its origin (by ſeparating the pectoral and deltoid muſcles), its branches under the pectoral muſcle will be ſeen, and alſo the trunk of the ſubclavian vein (2) originating from the baſilic and cephalic veins; and behind it the ſubclavian, or rather, as it proceeds downwards, the axillary artery (3). It is here, in the angle of the joining of the clavicle (n) with the acromion proceſs (o) (which projects upon the top of the ſhoulder and over the head of the arm-bone), that the attempt to compreſs the axillary artery is to be made in operations upon the joint, &c.—or the attempt is made above the clavicle, and at the outer edge of the origin of the maſtoid muſcle (q) from the clavicle.

Upon the fore part of the pectoral muſcle, again, ſeveral ſmall twigs of arteries will be found coming up through the interſtices of the ribs (4 5 6). Theſe are branches of the internal mammary artery. When minutely injected, they are ſeen inoſculating freely with each other, and with the twigs ſent from the axillary and ſubclavian arteries. The arteries coming round from the axilla by the lower edge of the pectoral muſcle are the extremities of the long thoracic artery (a branch of the axillary artery), which is alſo called the pectoral or external mammary artery (7).

All theſe arteries (and chiefly the laſt mentioned branch) throw out their blood in the extirpation of the mamma. The intricate ſituation of the axillary glands (8) ſhould be obſerved; that it may be underſtood how far theſe glands, being enlarged and diſeaſed, may encroach upon the trunk of the axillary artery.

The MAMMA in the female ſubject ſhould be attended to. The bulk of the mamma is made up of fat, which ſurrounds the proper gland: the central glandular part is a congeries of leſſer glands, connected by their ducts and veſſels, and inveſted in a firm opaque cellular texture. The arteries ſupplying the mamma, it muſt be evident, are thoſe already enumerated, viz. branches from the internal mammary; branches from the intercoſtal arteries; and the external mammary, or long thoracic artery *.

In diſſecting above the clavicle, and in carrying back the flap of ſkin from the ſide of the neck, in the angle betwixt the ſterno-cleido-maſtoideus muſcle (q r) and the trapezius (s), the fat will be found in moſt ſubjects looſe and watery, and of a granulated appearance, eſpecially in young ſubjects. This confuſed fatty maſs muſt not be taken away rudely, for under it lie many important parts. The EXTERNAL JUGULAR VEIN (9) will be found cloſe by the outer edge of the maſtoid muſcle; and paſſ-

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* If the ſubject ſhould be a woman who has lately nurſed, the opportunity of preparing this gland ſhould not be miſſed. This is to be done by cutting it out largely from its ſeat; introducing briſtles into the mouths of the ducts; and then withdrawing the briſtles, one by one, and introducing the mercurial injecting tube, the ducts are to be filled. As each duct is filled with mercury, the briſtle is to be again introduced, or the mouth of the duct ſeared with a red hot point. The preparation is then to be dried and preſerved in ſpirit of turpentine. See Walter de Anaſt. Tubulor. Lactifer. Mammæ Muliebris.

ing under the clavicle at the angle formed with it by the origin of the maſtoid muſcle (q), to join the ſubclavian vein, a conſiderable artery (the TRANSVERSALIS COLLI, a branch of the lower thyroid) will be obſerved (10), ſending its branches all over the ſide of the neck, and round under the trapezius muſcle. Betwixt this artery and the root of the external jugular vein, the OMO-HYOIDEUS MUSCLE (t) will be ſeen paſſing obliquely upwards at (v), to the os hyoides, a long and flat muſcle; and as it goes under the maſtoid muſcle, it may be ſeen degenerating into a middle tendinous part. Under this muſcle, again, and from betwixt the origins of the ſcaleni muſcles (w), the cervical nerves are ſeen deſcending to form the axillary plexus. The ſmall lymphatic glands (11), the GLANDULÆ CONCATENATÆ, may be obſerved lying upon the ſide of the neck. And further, it may be obſerved, that the ſmall nerve (13) which paſſes backwards over the maſtoid muſcle, and which lies cloſe to the muſcle and under the branches of the external jugular vein, is the NERVUS ACCESSORIUS, which comes out from the ſkull in union with the eighth pair. Lower down, behind the maſtoid muſcle, and lying upon the ſcaleni muſcles, there is found a delicate nerve (12), reſulting from the cervical nerves; and this is the phrenic or diaphragmatic nerve, which ſhould be carefully preſerved for the demonſtration of the nerves of the thorax.

It will be immediately underſtood how this part of the root of the neck and juſt over the clavicle, forms the moſt deadly aim of the aſſaſſin; for his knife paſſes at once into the breaſt, and pierces the great veſſels near the heart.

More towards the fore part of the neck we may obſerve the following parts. Upon lifting the maſtoid muſcle a little from its ſeat, and holding it aſide, the continuation of the omo-hyoideus muſcle (v) is ſeen paſſing upwards, and ſpreading into a ſecond belly. Under this the CAROTID ARTERY (14) and JUGULAR VEIN (15) are found lying in their ſheath; and betwixt them the PAR VAGUM, or eighth pair of nerves (16). A little more towards the fore part of the trachea a ſmall nerve is found coming down from the root of the tongue, and from under the angle of the jaw, viz. the DESCENDENS NONI (17).

Upon lifting back the maſtoid muſcle, the flat ribbon-like muſcles of the throat are found ſo accurately laid upon each other, and embraced and connected by the cellular ſubſtance, that the individual muſcles are ſcarcely to be diſtinguiſhed. The thyroid veins, lying upon the fore part of the throat, ſhould be preſerved; they run down in a direct courſe from the thyroid gland to the trunk of the left ſubclavian vein as it croſſes the top of the cheſt.

If the whole ſide of the breaſt and neck be thus regularly diſplayed, there will be no difficulty in lifting the outer layer of muſcles, and diſſecting the leſſer pectoral muſcle and ſubclavian muſcle. The PECTORALIS MINOR lies under the greater pectoral muſcle; conſequently it does not reach ſo far upon the cheſt, but riſes from the third, fourth, and fifth, ribs. From its dentated origins it has been called (in oppoſition to the proper ſerratus anticus muſcle) the SERRATUS ANTICUS MINOR. The fibres converging, it is inſerted into the point of the coracoid proceſs of the ſcapula. The SUBCLAVIAN MUSCLE lies concealed under the clavicle; its muſcular part lies more towards the end of the clavicle, connected with the ſcapula; its fibres deſcend obliquely downwards and forwards, and are inſerted into the firſt rib. Little more action can be conceived in this confined muſcle, than to ſtrengthen the connections of a moveable bone to the trunk. It ſhould be obſerved here, how far the ſhoulder projects from the thorax, and how narrow the cheſt is at the upper part;—for wounds paſſing aſlant the ribs, and through the pectoral muſcles and ſhoulders, are often with difficulty to be diſtinguiſhed from wounds penetrating the thorax. They may, however, be as dangerous by wounding the great arteries high in the axilla.

This enumeration of the muſcles and blood-veſſels, though apparently irregular, will, upon actual diſſection, be found more uſeful than a more regular detail.

SECOND DISSECTION OF THE THORAX.

Of Opening the Thorax,—and of the Connections of the Heart, Lungs, and Inveſting Membranes.

TO open the breaſt, the integuments are to be cut through in the length of the ſternum, and with the origin of the pectoral muſcle are to be diſſected back, until the joining of the cartilaginous and oſſeous part of the ribs is laid bare; which is obſervable by the difference of colour, the whiteneſs of the cartilage, and the livid or cineritious colour of the bony part of the rib. At this joining, the ribs, and the intercoſtal muſcles, are to be cut through; and the joint of the ſternum with the clavicle, being diſlocated, and the lower part of the ſternum ſeparated from the diaphragm, it is to be lifted upwards (as in Plate VI. fig. 1. a), or entirely removed. But if there is to be afterwards an injection of the veſſels in the breaſt, there will be a great deſtruction of ſmall branches of arteries, and much trouble in tying the internal mammary and intercoſtal arteries: in this caſe, therefore, it is better to ſaw through the ſternum at once, after the firſt inciſion, and violently to draw the divided ſternum aſunder; for by this the internal mammary arteries are preſerved—a great ornament to a preparation of the cheſt—and no arteries of importance are cut. In private diſſection, when the abdomen is to be opened after the thorax, the inciſion may be continued down from the ſternum to the pubis: for the integuments in all this length, from the clavicle to the pubis, will ſtretch ſufficiently to lay open the viſcera of the belly in this one longitudinal cut.

When the ſternum is lifted, as in Plate VI. the anterior mediaſtinum (b b) is ſtretched betwixt the pericardium (c), which covers the heart, and the under ſurface of the ſternum (a); and it muſt be cut before the ſternum can be fully raiſed. On looking under the ſternum, when raiſing it, the mediaſtinum may be ſeen ſtretched, and (as it is gradually torn from the lower ſurface of the ſternum) ſeparating into two layers (b b), and forming a triangular cavity (d).—This is more evident in young ſubjects. This cavity, when the ſternum is let down again, is ſeen to cloſe by the elaſticity of the membrane. In children, the mediaſtinum, and all the membranes lining the cheſt, are more delicate and tranſparent; and when the ſternum is thus raiſed, in this cavity which is artificially produced betwixt the layers of the mediaſtinum, the lowermoſt part of the thymus is ſeen. With little diſſection it may be diſplayed, ſtretching from the pericardium over the great veſſels which come from the heart, and even connected with the lower thyroid veins of the neck *.

When the ſternum is laid back, the parts appear thus: The diviſion of the thorax into two diſtinct cavities by the mediaſtinum (b b)—the lungs of each ſide (e f g h i) lying diſtinct from each other in theſe cavities—and betwixt them the heart, obſcured by the pericardium (c); and the cellular membrane, which, before the ſternum was raiſed, formed the anterior mediaſtinum, is ſcarcely to be diſtinguiſhed upon the pericardium.—The mediaſtinum (b b), dividing the thorax, will in the ſubject be obſerved to run obliquely; for on the lower part of the ſternum, and near the diaphragm, it does not adhere to the middle of the ſternum, but is removed towards the left ſide, and is attached rather to the cartilaginous parts of the ribs than to the ſternum. This makes the right cavity of the

* It was once a favourite demonſtration to diſſect off the ribs and ſternum, and leave the pleura entire, and to blow up the cellular interſtice of the layers of the anterior mediaſtinum.

cheſt larger than the other; and the difference is further increaſed by the heart (c) protruding from the mediaſtinum ſtill further into the left ſide.

The PLEURA is the membrane which lines both cavities of the cheſt: and as theſe cavities do not communicate, the pleura of each ſide is a diſtinct ſac; and, by their coaleſcing in the middle, they form the mediaſtinum. This diviſion of the thorax by the mediaſtinum keeps the lungs of one ſide independent of thoſe of the other—and the action of the reſpiratory muſcles will dilate the lungs of one ſide, although the cavity of the other ſide be laid open; and conſequently the lungs of that ſide fall collapſed and inactive. The inner ſurface of the pleura, where it lines the ribs, is denſe and ſmooth; but on the ſide attached to the ribs it gradually degenerates into the common cellular texture. Therefore, to divide the pleura into layers is not difficult: but ſtill the one layer will appear the common cellular ſubſtance, or the perioſteum of the ribs; while the other will be the ſmooth internal ſurface of the pleura.

If there be no preternatural adheſions of the lungs to the pleura where it lines the ribs, the general figure of the lungs is eaſily underſtood.—It will be ſeen, that the baſe of the lungs, or that part which reſts upon the diaphragm, is concave, anſwering to the convexity of the diaphragm; that they reach far behind the diaphragm; and that they are pyramidal towards the upper part of the cheſt, anſwering to the pyramidal ſhape of the connected ribs; every rib, as it is higher in the thorax, being the ſegment of a leſſer circle than that below it.

The lungs of each ſide are ſubdivided into lobes. Thoſe of the right ſide generally into three (e f g)—two greater ones, and an intermediate leſſer lobe; and the left into two lobes (h i). This, however, is ſometimes reverſed. Theſe lobes are again divided into groups of cells; and theſe again into a ſeries of ſmaller veſicles, into which the air is admitted by the minute and leſs rigid branches of the trachea. Into the ſulci, forming the diviſions of the lungs into lobes, the delicate membrane inveſting the lungs is continued. Theſe clefts in the lungs cannot ſurely be for allowing them eaſy motion, in adapting themſelves to the form of the cheſt, or in embracing the heart with their prolonged points: For as there is no cavity in the cheſt before it is opened, and as the ſurface of the lungs is cloſely applied to the ſurrounding ſurfaces, there can be no room for motion in the ſides of theſe clefts upon each other. On the contrary, they muſt keep as cloſely in contact as if they adhered: nor can one lobe retract whilſt another ſwells up to fill its place, as in the inteſtines—the motion of the lungs not being cauſed by their own powers of contraction or dilatation, but by that mechaniſm which ſurrounds them, and which muſt apply equally to all the lobes at once. It is evident, that the pleura has the ſame relation to the lungs, and inner ſurface of the cheſt, that the peritoneum has to the inteſtines and inner ſurface of the abdominal muſcles; and the pleura will be found finer, and more compact in its ſtructure, than the peritoneum.

That the relative ſituation of all the parts, and the inflections of the pleura, may be correctly underſtood, they may be illuſtrated thus: In the middle of the breaſt lies the heart, with the great arteries and veins proceeding from it, and the trachea and œſophagus.—Theſe all lying betwixt the ſternum and ſpine, would form a diviſion of the breaſt independently of the mediaſtinum. The lungs, again, lie upon each ſide, connected by their arteries and veins, and the branches of the trachea. Now, ſuppoſe two bladders, one on each ſide of the thorax, placed betwixt the lobes of the lungs and the ribs; ſuppoſe alſo that theſe were to ſwell till their ſides inſinuated into every interſtice, and covered every projection. The ſides of theſe cyſts, having ſtretched over the ſurface of the lungs, would, if allowed to meet in the middle of the breaſt, form a partition, conſiſting of two layers of membranes. But where the heart and great veſſels intervene, the cyſts would not coaleſce, but would contain them in their duplicature. Near the fore part, under the ſternum, and before the heart—they would meet: and behind, again, near the ſpine, they would contain, betwixt their layers, the

great veſſels running down the fore part of the vertebra; and as they came off from the ſpine over theſe veſſels, they would form a triangular ſpace, ſurrounding the œſophagus, aorta, vena ſine pari, and thoracic duct. Such, indeed, is the manner in which the anterior and poſterior mediaſtinum are formed by the two layers of the pleura. Only it will be obſerved, that in nature there is no actual coaleſcence of the pleura of each ſide to form the mediaſtinum, as the intervening heart and veſſels leave no interſtice for this union; unleſs the anterior mediaſtinum (b b) ſhall be conſidered in this light. But, to proceed with the illuſtration, ſuppoſing theſe bladders to be inſinuated betwixt the lungs, they would be ſtopped by the veſſels which go to the lungs from the heart; and ſurrounding them, they would form the LIGAMENTA PULMONUM. To carry the ſimilitude a little further for the ſake of illuſtration, let us ſuppoſe, that the outer ſurface of theſe ſacs were to adhere, at one part, to the inſide of the ribs, and, following the curve of the inſide of the cheſt, to adhere alſo to the veſſels going to the lungs, and to the lungs themſelves, a lively idea of the real ſituation of the pleura may be obtained. For this membrane may actually be traced from the inſide of the ribs over the vertebræ of the back, and from the vertebræ over the lungs, and then reflected from the root of the lungs to the mediaſtinum.

When the breaſt is opened, the lungs collapſe, ſince they are kept diſtended only by that complete vacuum which is in the thorax. By collapſing, they loſe their natural ſituation, and retire from before the heart. In their natural ſituation, the edges of the lobes almoſt completely ſurround the pericardium and heart. The heart, covered with its pericardium (c), is ſeen protruding its apex towards the left ſide, and puſhing the mediaſtinum, which covers the pericardium, before it. It is ſeated upon the diaphragm, to which (at k) the lower ſurface of the pericardium adheres, while the layer of the mediaſtinum is reflected off upon the diaphragm; and this layer can be diſſected from the pericardium in the young ſubject.

In this firſt view, the phrenic nerve (l) will be ſeen deſcending to the diaphragm upon the ſide of the pericardium, and turning over the apex of the heart. The veſſels which are ſeen upon the fore part of the pericardium belong to the ramus pericardio-diaphragmaticus of the mammary artery; and the larger branch which is ſeen accompanying the phrenic nerve is the ramus comes nervi diaphragmatici of the ſame mammary artery anaſtemoſing with a branch of the right phrenic artery.

The PERICARDIUM is a ſtrong white and compact membrane; ſmooth upon the inſide towards the heart; never adhering to the heart but in diſeaſe; and moiſtened with a continual exudation. It ſupports the heart in its place, allows it free motion in its natural play, and reſtrains it in its inordinate actions. When we lay open the pericardium (by ſlitting it up on the fore part), and expoſe the heart, the right ventricle (Plate VII. fig. 1. A) protrudes; the right auricle (e) is towards us; the left auricle is retired, and its tip is ſeen lapping round upon the left ventricle: from under this tip of the left auricle, a branch of the coronary vein and artery (d) proceeds down to the apex of the heart. The courſe of theſe veſſels may ſerve as a mark of the diviſion of the ventricles by the ſeptum, by which the cavities of the heart may be laid open; for they run parallel to the diviſion of the two ventricles by the ſeptum, and a little to the left of that diviſion. If this mark, or the natural diviſion of the ventricles, be not ſufficiently diſtinct upon the outſide of the heart, by graſping the heart in the hand, the left ventricle will be found firm, fleſhy, and reſiſting; whilſt the right ventricle is looſe, and feels as if wrapped round the other. But theſe marks, by which the heart is to be diſſected, will be afterwards obſerved more particularly.

Following up the right ventricle to the root of the artery diſemboguing from it, we find the artery (Plate VII. fig. 1. a) betwixt the two extremities of the auricles; then it ſeems to turn entirely round under the arch of the aorta (b); but it ſends only the right pulmonic branch under the aorta, while the left (B) goes to the lungs of that ſide. The aorta (b), again, ſeems to riſe from the middle of

the baſe of the heart, and takes a turn forwards from the left ventricle, which lies in a manner behind it.

Even in the uninjected ſtate of the heart, it can be obſerved how it is placed towards the left ſide of the cheſt, and how in its poſition, in regard to the ventricles, it is oblique too; as that ventricle which is called the right (A) is almoſt directly forward, whilſt the left (C) is behind, and almoſt completely hid by the right ventricle. It may alſo be ſeen how both ventricles reſt upon the diaphragm, making the lower ſurface flat, as if moulded by its own weight, and forming its obtuſe and acute margins; its point or apex being turned forwards and towards the left ſide, ſo as to ſtrike its pulſation upon the joining of the cartilaginous and bony part of the fifth rib.

Holding the pericardium from the right auricle, the inferior cava (i) is ſeen coming up through the diaphragm, and the ſuperior cava (c) coming down from the upper angle of the pericardium, and behind that part of the aorta which is within the pericardium. A probe can be introduced behind the ſuperior cava; in which caſe, the probe will be inſinuated betwixt it and the veins going from the right lung to the left auricle. Upon lifting the heart from its place, and preſſing upon the back part of the pericardium, it aſtoniſhes us at firſt to find the back-bone projecting ſo far forwards, and reſiſting the finger. Theſe marks are very uſeful in examining the parts in diſeaſe. It is uſeful to obſerve the ſituation of the heart in the breaſt: becauſe, being held in the ſame poſition when it is taken out of the body, the manner of laying it open can be ſimply deſcribed, and the deſcription of its diſeaſes eaſily underſtood.

In tracing the pericardium up to its connection with the great veſſels, it is found to be reflected from thoſe veſſels over the whole heart, and to form the outer covering of the ſubſtance of the heart. But here it is more delicate, and of a totally different nature from the proper pericardium. When this membrane which covers the heart is conſidered as the pericardium continued and prolonged, we are obliged again to explain its ſituation, when entire, by the aukward ſuppoſition of a continuous ſac, emptied and laid upon the heart. In which caſe, the outward layer would repreſent the pericardium; and that which was in contact with the heart, the membrane of the heart itſelf. That the connections of the pericardium may be underſtood, it is only neceſſary to lay it open: but to demonſtrate it more completely, a tube and ſtop-cock may be introduced by a ſmall puncture, and the pericardium ſtrongly blown up: then the layers of the mediaſtinum may be diſſected a little off it, and the connections at the root of the great veſſels ſhown, with its veſſels, nerves, &c.

It may be obſerved, in regard to the pericardium, that the heart is never what we would call completely filled; that is to ſay, the ventricles and auricles are not diſtended at once: but the action of theſe alternating with one another, the pericardium, inſtead of being alternately diſtended and relaxed, muſt, in the regular actions of the heart, be much more ſtationary than we are at firſt aware of. So in injecting the heart, though the pericardium, being entire, may reſtrain the too great enlargement of the auricles or ventricles, yet it is no meaſure of the quantity of injection to be thrown in; and it can give no aſſurance of the heart being filled with its natural proportion of fluid: for either the quantity which belongs to two of the cavities of the heart may be divided among the four, or if all are filled to the utmoſt of their natural diſtention, the inveſting pericardium muſt be ſtretched beyond its due ſize.

Fig 1

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Fig 2

Fig 3

See page 48

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Fig 1

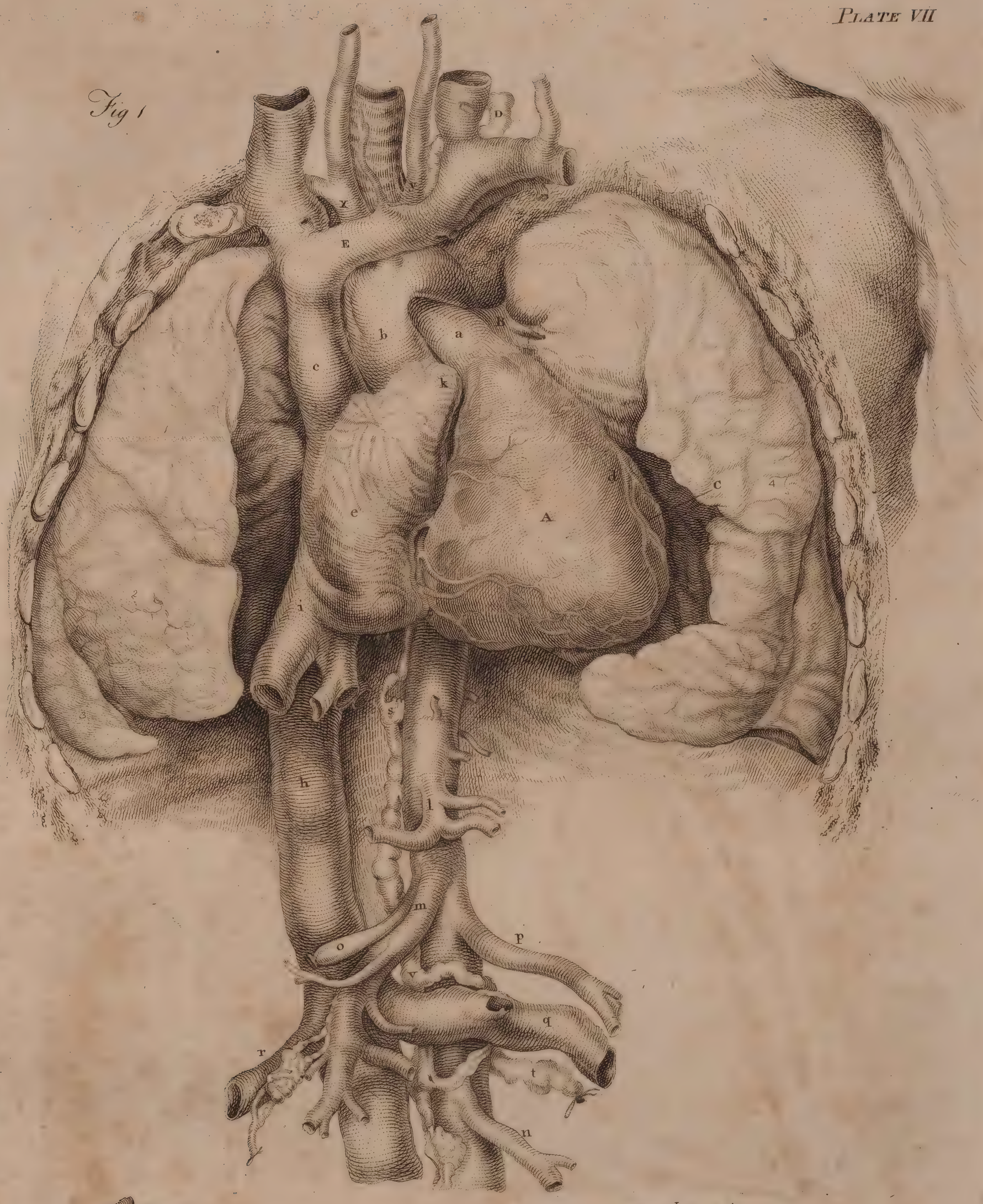
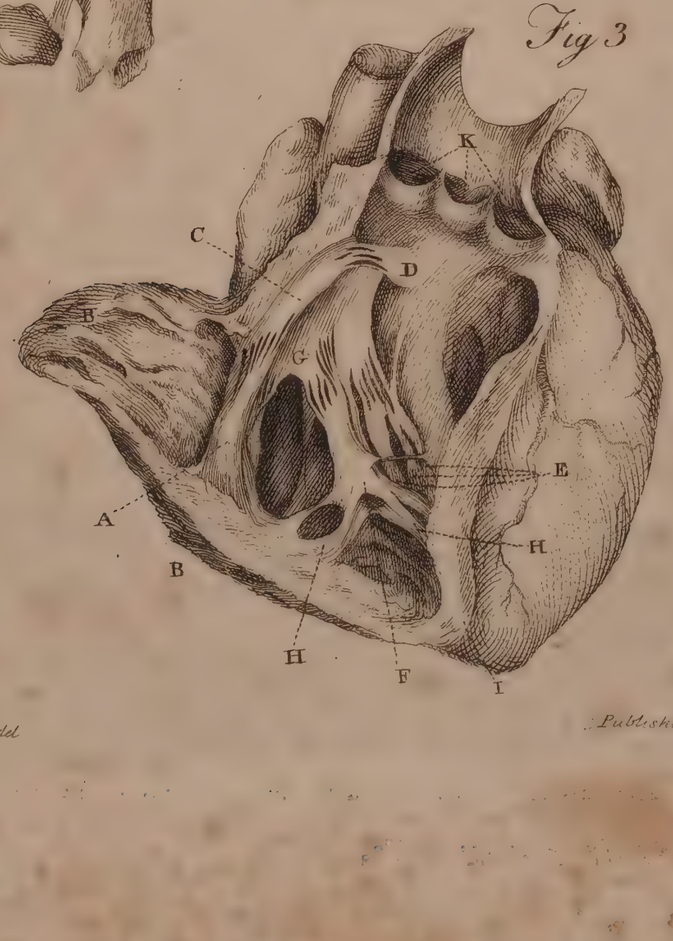


Fig 2

Fig 3



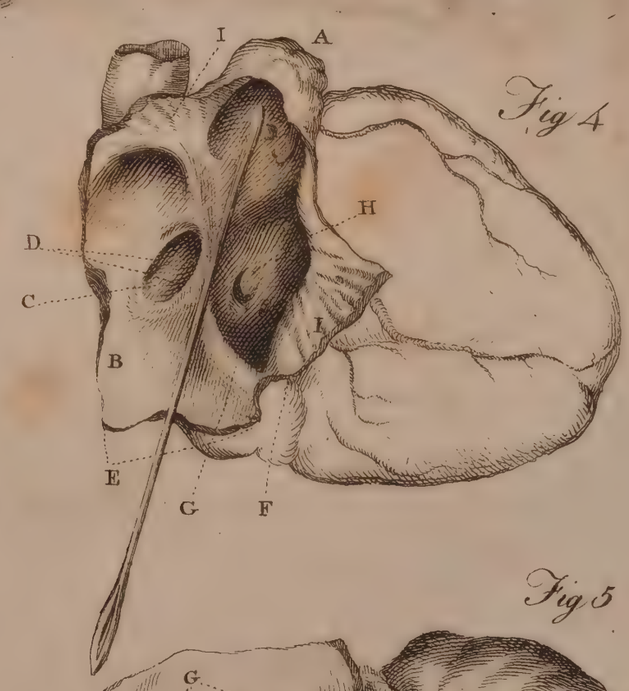
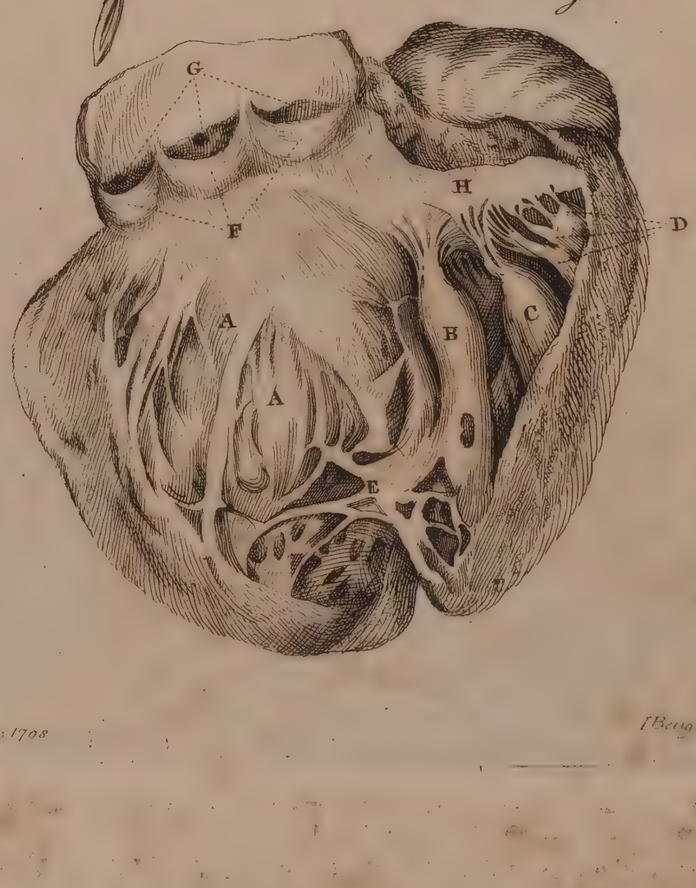


Fig 4

Fig 5



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THIRD DISSECTION.

Of Opening the Heart to Demonſtrate its Internal Structure;—and of Diſſecting the Coats of Arteries.

SUPPOSING the heart to be rudely cut away, with its veſſels ſhort, and to be held nearly in the poſition in which it lies while in the body, theſe marks may be obſerved:

Firſt, The PULMONARY ARTERY (Plate VII. fig. 2. A.) is before the aorta (B); and theſe veſſels are in a direction croſſing each other. Secondly, Upon the left ſide of the pulmonary artery, the tip of the LEFT AURICLE (C) appears; and under it a vein and artery (D), deſcending to the apex of the heart. Thirdly, The RIGHT AURICLE lies behind, and towards the right ſide of the aorta: a principal vein and artery (F) are ſeen emerging from the fat at the baſe of the ventricle, and under the margin of the auricle; they likewiſe run down to the apex of the heart. If the great arteries have been cut cloſe to the heart, the play of the ſemilunar valves may be obſerved by looking down into the veſſels, and raiſing the valves by blowing into them with the blow-pipe.

OF OPENING THE RIGHT SIDE OF THE HEART.—To open the RIGHT VENTRICLE, an inciſion may be made from the root of the pulmonary artery (A) down to the apex of the heart, parallel with the right branch of the left coronary artery and its accompanying vein (D), which come out from under the left auricle, but a little to the right of thoſe veſſels (G G). By a cut made in this direction (care being taken to cut no deeper than the thin ſides of this ventricle), none of the columnæ carneæ will be cut; for the ventricle will be opened exactly to one ſide of the ſeptum of the heart: and being then enabled to ſee what parts are to be cut, the inciſion may be continued round the baſe of the heart, in the direction of the dotted line (H H), by the root of the pulmonic artery and margin of the right auricle: or the firſt inciſion (G G) may be continued round the point or apex of the heart, ſo as to lay it open as if it were cleft or ſplit from the apex.

The action of the ſemilunar valves of the pulmonary artery being examined from below, that artery may be ſlit up, and the inſide of the right ventricle be diſplayed, as in fig. 3.

OF THE PARTS SEEN UPON OPENING THE RIGHT VENTRICLE (Plate VII. fig. 3.).—Firſt an irregular column of fleſh (A) is ſeen riſing from that part of the ventricle which is laid back, and dividing into eight delicate cordæ tendineæ; and theſe are again expanded into a broad tendon (C), which is the anterior diviſion of the tricuſpid valve. From a little mammillary proceſs of fleſh (D), near the valves of the pulmonic artery, and where the ſurface of the ventricle is ſmooth, there is ſent out, in three diviſions, a great number of delicate cordæ tendineæ; and which are alſo connected with this anterior diviſion of the valve (C). The next diviſion of the origins of the cordæ tendineæ is from the ſeptum of the two ventricles; from which they ariſe by ſeparate little pillars of fleſh (E). And, again, from the backmoſt part of the ventricle there is a ſtrong pillar of fleſh (F), having a double origin from the two oppoſite ſides of the ventricle, and to which the great poſterior diviſion of the membraneous valve is attached. The tranſverſe connections betwixt theſe muſcular attachments of the valves ſhould be obſerved. From theſe three diviſions of this circle of membrane which ſurrounds the opening from the auricle into the ventricle, it is called the tricuſpid valve. It muſt be conſidered rather as the ventricular valve of the right ſide than as the valve of the auricle; in the ſame way that the valve in the great artery is called the ſemilunar valve of the aorta.

The ſmoothneſs of the ventricle towards the opening into the pulmonic artery may be obſerved: and the pulmonic artery being ſlit up (as in fig. 3.), the three ſemilunar valves of this artery (K) will be ſeen. Theſe valves are more frequently perforated in the edges than thoſe of the aorta.

Of opening the auricle.—A ſmall part of the trunk of the vein ſhould be left unopened; for when it is entirely ſlit up, it will not be always eaſy to diſtinguiſh the mouth of the vein, nor, conſequently, the ſituation of the parts as relative to the courſe of the blood.

To lay open the right auricle, introduce a probe or blow-pipe into the lower cava (fig. 2. I), carrying its point to the projecting part of the auricle at (K), which lies contiguous to the root of the aorta. Uſing this as a directory, the auricle may be ſlit up in the direction of the dotted line (fig. 2. I K); by which the Euſtachean valve, and every important part, will be avoided. Continuing to hold the heart nearly in the ſituation in which it lies while in the body, upon the flap (B, fig. 4.) which is laid towards the right ſide of the heart, the remains of the foramen ovale may be ſeen (C D) in the partition dividing the two auricles. This foſſa ovalis is an irregular depreſſion, of an oval form, with its border (eſpecially upon its upper part) elevated into a ring. It may be diſtinguiſhed by the difference of colour by which it is ſurrounded: its margin (D) is white, and has more the appearance of tendon. Within this there is a circle of thoſe fleſhy fibres which form the musculi pectenati (I) of the auricle; and the membranous part in the middle, which performed the office of a valve in the fœtus, is white and more callous, and being ſunk ſomewhat reſembles the tonſils in the throat. This membranous part (marked C fig. 4.) ſeems continuous with the margin upon the lower part, while, upon the upper part, it goes behind the margin of the foſſa: and here (exactly in the direction of the dotted line C, fig. 4.) it may be examined with the probe, if the valve be ſtill open, which it frequently is in children.

If the lower cava, where it expands into the auricle, be held open, or if the vein (I, fig. 2.) be ſlit up with the auricle (as it is in fig. 4. E)—then, by extending the point (F) upon the left ſide of the vein, there will be ſeen a membrane ſtretching from the inner ſide of the margin of the foramen ovale, round upon that half of the root of the vein neareſt to the opening of the auricle into the ventricle.—This is the eustachean valve (G): it is like the duplicature of the inner membrane of the auricle.

Behind the Euſtachian valve is the opening of the great coronary vein (H); which, running round the margin of the left auricle, gathers the ſmaller coronary veins. The little ſemilunar valve on the mouth of this vein was likewiſe firſt deſcribed by Euſtachius.—Several mouths of ſmall veins may be obſerved near it, and having all little pellucid valves covering their mouths.

When the auricle and ventricle of the right ſide are thus laid open, the play of the tricuſpid valve may be obſerved by holding out the auricle, and allowing the ventricle gradually to ſink in water, when the valves will riſe, and cloſe the opening into the ventricle.

Of opening the left side of the heart.—Introduce the blade of the ſciſſars into one of the pulmonic veins, and inſinuating it into the part of the auricle which projects by the ſides of the pulmonic artery (fig. 2. C.), ſlit it up. Little is to be obſerved in this auricle: the musculi pectenati are not ſo ſtrong nor ſo evident upon its inſide as thoſe of the right auricle. The pulmonic veins open almoſt always in four mouths; thoſe from the right lungs being cloſer together than the left branches.

To expoſe the left ventricle, make an inciſion as far towards the left ſide of the vein which runs down from the tip of the left auricle to the apex, as the inciſion made to lay open the right ventricle was to the right of theſe veſſels. In opening this ventricle there is leſs fear of cutting upon the columnæ carneæ, or upon the ſeptum; as the right ventricle, being open, the ſeptum is ſeen, and we can cut immediately on the other ſide of it; while the columnæ are collected in the further ſide of the ven-

tricle, round the opening of the auricle, and are not much expoſed to the knife (See B C D, fig. 5.). Continuing the upper part of the inciſion round under the projecting auricle, ſlit up the aorta to ſhow its valves: in doing which, that branch of the left coronary artery which comes out under the margin of the left auricle (fig. 2. D) muſt be cut through. When this ventricle is laid open, that part which is towards the ſeptum is very little rugged with the interlacements of the columnæ carneæ, eſpecially towards the opening into the artery (A A). The fleſhy columns (B C D), on the contrary, which are connected with the mitral valve (H) (that valve which prevents the retrograde motion of the blood into the left auricle), are thick and ſhort, and confined in a corner of the ventricle; nor do they ſpread their roots ſo extenſively as thoſe of the right ventricle. Two larger maſſes of theſe muſcular columns, by which the valves are connected with the ſides of the ventricle, may be obſerved (B C). That which is before the other (B) may be cut from its root, and thrown back with the portion of the valve to which it is connected. In what reſpect this circle of valve reſembles a mitre, it is difficult to diſcover; but perhaps the more abſurd the names of parts in anatomy are, ſo much the better are they remembered.

The connections of theſe valves are ſo much alike in every eſſential circumſtance to thoſe of the right ventricle, that a deſcription of the effect of the contraction of the muſcular columns will apply equally well to both.

Turning our attention to the ſemilunar or ſigmoid valves, we may obſerve, that in the child they are delicate and looſely floating membranes, variegated in part by a white opacity; while their edges are at ſome places ſo tranſparent, that there appears often to be real deficiencies of the valve near the edge, when there is none:—It however happens not unfrequently that ſuch deficiencies really do exiſt. In the adult, theſe valves acquire greater firmneſs and ſtrength, and are totally opaque. Behind each of the valves are ſeen the LESSER SINUSES OF THE AORTA (fig. 5. G).—The uſe of thoſe cavities behind the valves has been often conſidered, but not ſatisfactorily explained: they ſeem to be intended to prevent the poſſibility of the valve being forced againſt the ſides of the artery by the ejection of the blood from the ventricle. If no ſuch proviſion were made, the blood would, upon the reaction of the artery, have no power upon them to throw them down upon the ventricle. But by this ſinus or cavity behind each of the valves, they are held as if in the middle of the ſtream of the retrograde blood; and in its firſt movement backwards they are forced together ſo as to prevent the regurgitation of the blood into the ventricle. The mouths of the coronary arteries (I, fig. 5.) open behind the two valves which are upon that ſide of the aorta, contiguous to the pulmonary artery.

It is diſputed whether theſe ſemilunar valves affect the paſſage of the blood into the coronary artery. But though the valves were thrown ſo cloſe upon the ſides of the aorta as to cloſe the mouths of the coronary arteries during the ſyſtol of the heart, ſtill that quantity of blood, which is behind the valve upon its being thrown back, would as effectually be propelled into the coronary arteries as if no valve intervened.

See, below, Diſeaſes of the Heart.

OF THE ACTION OF THE TRICUSPID AND MITRAL VALVES;—AND OF THE EFFECT OF THE CONNECTIONS OF THE COLUMNÆ CARNEÆ.

THE diſputes and variety of opinions about the action of the tricuſpid and mitral valves have ariſen from the ſuppoſition, that the calumnæ carneæ were merely the attachments of the cordæ tendineæ to the fleſh of the ventricles. And, upon this ſuppoſition of their inactivity, the whole attention was beſtowed upon the contraction of the ventricle, and the approaching or retiring of the apex of the heart from its baſe during its action. Nor does it ſeem ever to have been conſidered what is the peculiar connection of the roots of the columnæ carneæ to the parietes of the ventricles, or what effect the dilatation of the cavities of the heart muſt conſequently have upon them.

But ſince thoſe connections of the membranous valves of the auricle are only in part tendinous, while much of their length is muſcular (viz. the columnæ carneæ), it is natural to ſuppoſe, that thoſe muſcular columns are ſynchronous in their action with the ſides of the heart itſelf, with which they are intimately blended. While the action of the auricle is dilating the ventricle, and the cavity of the ventricle is diſtending in every direction, the cordæ tendineæ will be ſtretched, and the attached muſcular columns will be relaxed, while the heart itſelf is relaxing. And it may be obſerved, that in whatever direction the ventricle is dilated (whether in its tranſverſe or longitudinal diameter), the connections of the little muſcles attached to the valves are ſuch, that they muſt be extended and relaxed.

Again, during the contraction of the ventricle, the columns of Lower contracting alſo (the muſcular fibres of both having been excited by the diſtention of the ventricle) as the apex of the heart approaches the baſe (or the opening of the auricle into the ventricle) to which the valve is attached, the cordæ tendineæ are ſhortened by the contraction of their muſcular attachments:—and by this means the valves are reſtrained from being inverted, and the blood from eſcaping backwards into the auricle from the contracting ventricle.

This explanation of the action of the columnæ carneæ does not reſt upon the preſumption of the elongation of the heart in its axis; which is a diſputed point.—For if the connection of theſe little muſcular columns be attended to, it will appear that their elongation and relaxation muſt take place during the filling of the heart with blood, in whatever direction the ventricle is dilated by the influx of blood. For inſtance, in the right ventricle, the larger pillars connected with the valves have their baſe riſing from the three oppoſite ſides of the heart; and the leſſer columns run in a direction acroſs the cavity of the heart,—or croſs bridles may be obſerved, which, being fixed into the longitudinal columns, muſt elongate their fibres upon the dilatation of the ventricle in width. And it may be obſerved, that by the contraction of the fleſhy roots of the chief columnæ (as at H H fig. 3.), they have a greater combined effect upon the point (F), or pull it through a greater ſpace, in a middle courſe directly in the axis of the heart, than if the column of muſcle attached to the valve ran in a direct courſe from the valve (G) to the apex of the heart (I). And it will readily be conceived, that the relaxation of the muſcular power in theſe decuſſating fibres of the columnæ carneæ, will allow an equal latitude to the lengthening of the cordæ tendineæ (inverſely as their powers of contraction), when the heart is dilating by the influx of blood from the contracting auricle.

From all this, it may be underſtood how very imperfectly experiments, by filling the dead heart with water, will illuſtrate the play of the valves in the living body.

OF THE DISSECTION OF THE COATS OF ARTERIES.

TO prepare the coats of an artery neatly, it ſhould be injected with coloured tallow, and its coats diſſected and pinned out; or the diſſected coats threaded with a ſtrong briſtle, to keep them ſeparate. —It is then to be preſerved in ſpirits. To ſhow its inner ſurface, it may be opened, the injection picked from its cavity, and its ſides held ſeparate, as in Plate IX. fig. 5. and 6. Even where we have to examine diſeaſes (as in aneuriſms, in oſſifications of the coats of the arteries of the extremities, in ſtumps after amputation, or in diſeaſed lungs, &c.), a cautious injection will not injure the diſeaſed appearances in the cavity of the veſſels, while it has the advantage of enabling us more eaſily to trace the blood-veſſels in diſſection, and to examine more accurately their connections with nerves, or diſeaſed parts. And the whole artery, if filled with injection, preſerves, when diſſected out and prepared, an intelligible ſhape, as in Plate IX. fig. 6.

For the manner of demonſtrating the muſcularity of arteries, I muſt refer to the Introduction, p. xii.

There are, ſtrictly ſpeaking, only four coats in an artery;—the outer cellular coat—the muſcular coat—the inner cellular coat—and that coat which forms the inner ſurface of the artery. To diſſect the more numerous diviſions of the coats, as deſcribed by ſome authors, the chief dependence muſt be placed upon the outer cellular coat; for this coat may be ſeparated into layers making up any number of coats, while the others are more diſtinct, with ſomething like a natural diviſion between them.

The external cellular or vascular coat, (fig. v. 1.).—By this coat the artery is connected with the parts in which it lies imbedded. It is covered in the great cavities by the general inveſting membrane, as the pleura or peritoneum. The ſmall arteries which ramify upon the larger trunks of arteries (the vasa vasorum) run chiefly in this external coat.—Theſe arteries are not, in general, derived from the larger veſſels on which they lie, but come from ſome of the ſurrounding ſmaller branches of arteries. They are to the great arteries as the coronary arteries are to the heart.—They ſupply and nouriſh the coats of the arteries, while the column of blood in their cavities ſeems to have no reciprocal action with the ſides of the great arteries. To prepare theſe ſubordinate veſſels, they muſt be injected minutely (while they lie in ſitu) with ſize, or fine varniſh injection, of a light colour, or of pure white. If after this minute injection a coarſer and dark coloured injection be thrown into the trunks, the light coloured and fine injection will be puſhed onward, while the coarſe injection fills only the trunks; making thus a contraſt between the large veſſels and the ramifications of the vaſa vaſorum upon its ſurface. The artery, when thus injected and prepared, may be dried and varniſhed, or preſerved in ſpirits.

The outer cellular coat of an artery may be ſeparated into many layers.—In fig. v. 1. 2. it is ſeparated into two; on the other ſide into three layers (3). Theſe layers are gradually, as they proceed inwards, changed in their nature from that of the general inveſting cellular membrane, and are at laſt incorporated into a more regular coat; which has been called the tendinous coat (fig. v. 2.). It may be uſeful to obſerve, that it is this coat, according to Haller, upon which depends the tortuous ſhape of arteries; and that when it is taken off the artery loſes its peculiar character. The great peculiarity of the external coat is that which has been hinted at, viz. that while its inner ſurface, contiguous to the muſcular coat, is more accurately defined, its outer ſurface ſeems imperceptibly to degenerate into the nature of cellular ſubſtance. This cellular ſubſtance, which ſeems to ſurround the artery more looſely, forms ſheaths, which, in the diſſection of ſome parts of the body, it is neceſſary to preſerve. Of this kind is the ſheath which ſurrounds the carotid artery, jugular vein, and eighth pair of nerves, in the neck. It is very neceſſary often to ſhow the ſituation of veſſels in regard to the bed of cellular ſubſtance and fat in which they lie. Indeed nothing is of more conſequence to the ſurgeon; for if we are taught the anatomy of accurately diſſected muſcles only, and of injected veſſels cleared from all confuſion, we can ſcarcely hope to recogniſe an artery in an operation on the living body. In a demonſtration, therefore, if the ſtudents have not ſeen the whole progreſs of the diſſection, ſome part of the artery ſhould be left in its native confuſion. The cartilaginous, tendinous, or proper cellular coat, then, of an artery, is the inner layer of this firſt coat, which has now been conſidered in its greater latitude. It is certainly a more appropriated coat, but outwardly it is undefined.

The muscular coat.—Having diſſected theſe outer layers, the muſcular coat (Plate IX. fig. v. 3.) appears. Its fibres run in circles round the artery; no fibres run in the length of the artery. The circular fibres of the muſcular coat are imperfect.—On attemping to trace any ſingle fibre, it will not be found to make a complete circle round the artery; but the circle is made up of ſegments of fibres irregularly combined, the extremities of which are intermixed, and ſeem loſt among each other.

THE INNER CELLULAR COAT.—In diſſecting a diſeaſed artery, with concretions formed in its coats, the concretions are, upon lifting the muſcular fibres, found ſituated in the INNER CELLULAR COAT; if indeed it deſerves the name of a coat, ſince it is rather a connecting medium betwixt the muſcular and the innermoſt coat of all. This inner cellular coat is difficult to be demonſtrated;—but by ſlitting up the artery, and tearing off its innermoſt coat (fig. v. 4.), the exiſtence of this one may be ſhown; it appears alſo in the oſſified ſtate of the artery, when the concretions are ſeen under the muſcular coat upon the outſide, and unconnected with the innermoſt coat upon the inſide.

FOURTH DISSECTION OF THE THORAX.

Of the Injection and Diſſection of the Heart and adjacent Veſſels.

OLD ſubjects ſhould never be taken for the purpoſe of preparing any of the viſcera; for the fat is in old age peculiarly accumulated about the viſcera, both of the abdomen and of the thorax. Nor is the fat depoſited here derived from the extremities; for although the limbs of old people ſeem, during life, ſhrivelled and lean, yet the oil contained in them makes them alſo uſeleſs for preparing:—although dried with the utmoſt care, they ſweat out greaſy matter, which mix with and diſſolves the varniſh; and they never make clean nor laſting preparations. If the heart, therefore, has much fat accumulated about it, there ſhould be no heſitation in ſacrificing it, as a preparation, to the attainment of ſome other point of inquiry; as the examination of its internal ſtructure, &c.

To make a good injection of the heart, it is neceſſary to have the coagula well waſhed from its cavities; to have it warm and moiſt; and to pay particular attention to the filling of the coronary veſſels, upon which the beauty of the preparation much depends. The coronary veins, and even the arteries, may be injected ſeparately, by introducing a long tube down the cava and aorta; or the fine injection may be thrown in in this manner; while they are filled with the coarſe injection, at the ſame time that the cavities of the heart are injected. By this means the ſurface of the heart is beautiful, the minute ramifications of theſe veſſels being filled with colours anſwering to the colour of the injection in the right and left ſides of the heart. The right ſide of the heart will be moſt advantageouſly injected from the left jugular vein, or the injection may be made by any of the other large veins. From any of theſe the right auricle and ventricle, with the pulmonary artery and coronary vein, will be filled. The left ſide of the heart may be injected from the aorta below the diaphragm, or from the axillary or carotid arteries of either ſide. By this injection all the arteries of the breaſt will be injected; the coronary arteries; the left ventricle (by the wax breaking down the valves of the aorta);—and from the ventricle the wax will find its way into the left auricle, and into the pulmonary veins. If in filling the heart the injection, by flowing down upon the veſſels in a full ſtream, ſhould raiſe the valves, either in the aorta or in its paſſage into the auricle from the ventricle, the valves may, by kneading or irregularly compreſſing the heart, be moved from their hold, and the injection have acceſs to the whole ſide of the

heart:—but to prevent the poſſibility of the valves of the aorta being ſhut by the injection, they may be lacerated by introducing a probe down the aorta; or a tube may be introduced into one of the pulmonary veins,—though this will be ſeldom neceſſary. The knowledge of the diſtribution of the veſſels will teach us how careful we muſt be to tie all the leſſer branches of the aorta and the veins previouſly to injection. In injecting the veins, the vena cava may be tied above the diaphragm, or below the liver; by which the venæ cavæ hepaticæ will be filled.

The THORACIC DUCT may alſo be injected.—If ſought for in the abdomen, it will be diſcovered at its dilated part (Plate VII. fig. 1. v.) at the root of the myſenteric veſſels; or upon the left ſide of the aorta (at t), as one of its branches runs under the aorta; it is then ſeen going up under the diaphragm, alongſt with the aorta, and upon its right ſide, cloſe to the ſpine (s). In the thorax, it may be diſcovered running up betwixt the aorta and vena-ſine-pari. If it lie collapſed and undiſtinguiſhable, it may be raiſed by blowing into ſome of the glands upon the root of the myſentery, or into thoſe upon the courſe of the external iliac veſſels, or even into thoſe without Poupart's ligament in the groin. It muſt be injected with a different colour from the veins, that it may not be confounded, in the thorax and at the root of the neck, with the branches of the veins.

In injecting the heart when out of the body, the numerous branches of the ſubclavian arteries and veins, and the intercoſtal arteries coming off in the whole length of the aorta, muſt be tied. And to make ſure that all veſſels are tied, except thoſe into which the tubes muſt be introduced, let the heart and lungs be laid in a flat baſon, and covered with water; then, by blowing into the principal trunks, all the open mouths of arteries will be eaſily detected.

OF THE VESSELS TO BE TRACED IN THIS DISSECTION.

In the firſt place, the pericardium being diſſected off, all is made clear for the diſſection of the heart and great veſſels:—Then the fat which obſcures the coronary veſſels is to be diſſected away;—the great coronary vein is to be ſhown encircling the baſe of the heart, and emptying itſelf into the right auricle:—The right and left coronary arteries are alſo to be diſplayed; they need little diſſection, but upon the baſe of the heart.

In diſſecting betwixt the aorta and pulmonary artery, there may be obſerved a kind of ligament between them, which is the remains of the DUCTUS ARTERIOSUS. The branching of the pulmonic artery (Plate VII. fig. 1. a) to the lungs of each ſide being diſſected, and the right branch followed under the arch of the aorta, and the branches of this artery, and the pulmonic veins, diſplayed for ſome way ramifying in the lungs—we muſt proceed with the aorta (b), as it riſes from the heart, where it is called the aſcending aorta. In young ſubjects, the THYMUS muſt be attended to: it is to be lifted from the pericardium and great veſſels, and folded over upon the neck. Its blood-veſſels will be found coming out from the root of the internal mammary artery of each ſide, and attached to the thyroid or tracheal veins. Upon the top or utmoſt convexity of the aorta, three important branches (x y z) are ſent off towards the right ſide: the arteria innominata (marked x) quickly divides into the right ſubclavian and right carotid arteries; the middle branch (y) is the carotid of the left ſide; the other (z) is the ſubclavian artery of the ſame ſide.

But the SUPERIOR VENA CAVA (C), and the trunk (E), common to the jugular and ſubclavian veins of the left ſide, croſs before theſe important arteries. The ſuperior vena cava, ſhooting up from the right auricle, and having eſcaped from the pericardium, is joined upon its back part by the VENA AZYGOS. This vein coming forward in an arch from the ſpine, upon which it creeps to one ſide of the aorta, and before the intercoſtal arteries, it pours its blood, gathered from the back part of the cheſt, into the ſuperior current of blood. The vena cava, having got a little higher than the arch of the

aorta, ſtretches a great arm (the left ſubclavian vein) (E) acroſs the top of the cheſt, and before the root of the arteries which go to the head and arms. This branch, dividing into the internal jugular and the ſubclavian veins, receives the blood from the left ſide of the head and neck and from the left arm: and at the angle formed by the joining of the internal jugular and ſubclavian veins of this ſide, the THORACIC DUCT (D) empties itſelf into the circulating ſyſtem.

OF THE LESSER VEINS.—The VENA MAMMARIA INTERNA of the right ſide comes off from the upper part of the ſuperior vena cava, where it is about to divide. Upon the left ſide, it comes off from the ſubclavian vein, oppoſite to the cartilage of the firſt rib. The DIAPHRAGMATICA SUPERIOR, or PERICARDIO-DIAPHRAGMATICA, on the right ſide, joins the vena cava at its bifurcation; on the left, it joins the ſubclavian below the mammaria. The THYMICA, on the right ſide, ſometimes joins the vena cava; ſometimes the gutturalis or thyroid vein, or ſome neighbouring branch: on the left ſide it empties itſelf into the ſubclavian vein. The RIGHT PERICARDIAC VEIN enters the root of the right ſubclavian vein: on the left ſide it joins the ſubclavian vein, or the diaphragmatica, or the mammaria interna. The THYROID VEIN, or TRACHEALIS, or GUTTURALIS, of the right ſide, is inſerted into the bifurcation of the vena cava: on the left ſide, into the upper and back part of the left ſubclavian. The diſtribution of theſe veins is deſcribed in their names. It is for the moſt part very regular; but their communications with the larger veins are very inconſtant, and differ in each ſide as the great trunks are different. There is little uſe for a minute knowledge of theſe veſſels, unleſs that we may be able to tie them in injections *.

OF THE LESSER ARTERIES.—The SUBCLAVIAN ARTERY is the great ſource of the numerous ſmaller arteries which ramify in the thorax, upon the mediaſtinum and pericardium, and upon the under ſurface of the ſternum; and of thoſe alſo which ſeem to come out from the thorax to be diſtributed upon the root of the neck and ſhoulder.

1ſt, The INTERNAL MAMMARY ARTERY of the right ſide is the firſt branch which the ſubclavian artery of the right ſide gives off after parting with the carotid. It is ſeen running upon the inſide of the cartilages of the ribs near the ſternum: It ſupplies much of the contents of the thorax anteriorly; and inoſculates with the epigaſtric branch of the fœmoral artery upon the abdominal muſcles.—It gives off the ARTERIÆ THYMICÆ.

2d, The INFERIOR THYROID ARTERY is the ſecond branch of the ſubclavian artery, and is ſubdivided into theſe branches: The RAMUS THYROIDEUS—the RAMUS TRANSVERSUS COLLI—the RAMUS THYROIDEÆ ADSCENDENS—the TRANSVERSALIS SCAPULARIS, which, however, is as commonly the third branch of the ſubclavian, under the name of SUPRA SCAPULAR ARTERY.

4thly, The VERTEBRAL ARTERY, going from behind the ſubclavian artery, enters the vertebral hole of the ſixth vertebra of the neck.

5thly, The CERVICALIS PROFUNDA—and,

6thly, The CERVICALIS SUPERFICIALIS.

Theſe two laſt are, however, frequently ſupplied by the wide ſpreading branches of the thyroid artery: and indeed we muſt reckon ourſelves very fortunate in diſſection, when we can furniſh branches for thoſe numerous names.

7thly, The SUPERIOR INTERCOSTAL ARTERY, with its accompanying vein, can ſcarcely be diſſected

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* As the right auricle of the heart lies upon the diaphragm, the inferior vena cava muſt be very ſhort. If the VENA AZYGOS had emptied itſelf into the vena cava at this place, it muſt have climbed upon the diaphragm, and been affected by its alternate action, and muſt have joined the cava within the pericardium. It follows the general courſe of the veins of the thorax, which go to terminate in the branches of the ſuperior vena cava, where there is more eaſy acceſs to them.

while the contents of the cheſt are in their place, as it lies cloſe to the joining of the upper ribs with the ſpine, and comes from the back part of the ſubclavian artery.

All theſe arteries will be more accurately told in the diſſections of the neck and arm; and plans will be given to facilitate the explanation.

In preparing for the diſſection of theſe veſſels, the reader may obſerve the general diſtribution of the nerves in the following diſſection; and mark the points at which they are complicated with the arteries and veins, &c.

To continue the diſſection of the aorta, as it lies upon the ſpine deep in the cheſt, the lungs, and even the heart, would need to be taken away, to have a full demonſtration of its branches, which are but few and inſignificant. But by folding back the lungs from one ſide of the cheſt, any thing important may be ſufficiently obſerved. In tracing the aorta as it goes down upon the ſpine, the following are the chief branches: The BRONCHIAL arteries are ſent off to the root of the lungs, three or four in number, for nouriſhing the proper ſubſtance of the lungs. The OESOPHAGEAL arteries are ſent off in ſmall twigs to the œſophagus, as the aorta paſſes parallel to it in the poſterior mediaſtinum: And ſmall arteries are ſeen coming off from the aorta, at regular intervals as it proceeds downwards; and running into the interſtices of the ribs, they proceed along a groove in the lower edge of each rib.—Theſe are the INTERCOSTAL arteries, and are accompanied by branches from the vena azygos.

DISSECTION FIFTH.

Diſſection of the Nerves of the Neck and Thorax.

TO illuſtrate the diſſection of the thoracic nerves, there is given in Plate VIII. a ſketch of the courſe of the PAR VAGUM, the INTERCOSTAL, and the PHRENIC nerves of the right ſide: and as the ſubject from which this drawing was made was diſſected for this purpoſe alone, the order of the diſſection, and the deſcription of the nerves, ſhall be given as from that ſubject, and will conſequently tally in every point with the plate.

To diſſect nerves ſucceſsfully, and without confuſion, much will depend upon the method purſued. In a careleſs and incautious diſſection, it will often appear that there are many branches nowhere to be diſcovered in the deſcriptions of anatomiſts; for if a nerve lying under a membrane (the intercoſtal nerve, for example, in the thorax) be traced from trunk to branch, and the membrane diſſected as we proceed with the nerve—the filaments of the nerve are found ſo entangled with the fibres of the ſurrounding membrane, that, both being ſtretched, it is impoſſible to diſcover the difference of their texture, or which is the filament of the nerve. Particular attention ought therefore to be paid to the general courſe of a nerve before the membrane be lifted which covers it. It ſhould be obſerved what branches it ſends off, and in what direction; for while they lie thus in their natural ſituation, under a tranſparent membrane, they can be diſcovered by their ſuperior whiteneſs, and by the ſpiral direction and cloſeneſs

of their fibres. Afterwards, the membrane (the pleura for example) being cautiouſly diſſected off at once, the nerves are ſeen as yet unſtretched and undiſturbed, and may be eaſily followed. As they are traced, ſlips of coloured paſteboard or bougies may be ſlipt under them; ſo that being once unravelled they may not be again entangled with the cellular membrane.

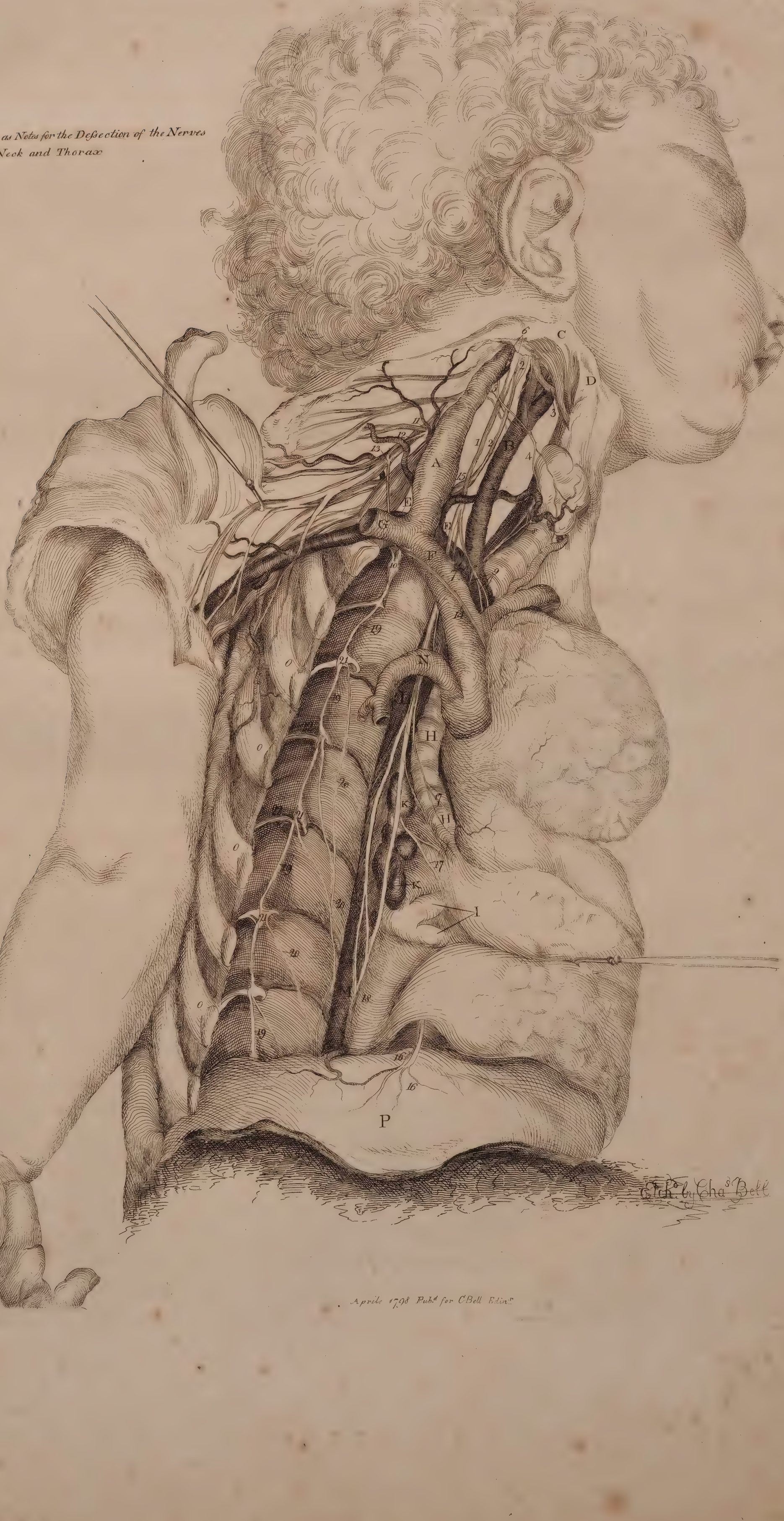
To conduct the diſſection of the thoracic nerves, as diſplayed in Plate VIII. tie the aorta as it proceeds from the heart, and the ſuperior vena cava as it is about to enter the right auricle: Then, fixing a tube into the aorta in the abdomen, inject upwards; by which are filled the carotids, with the ſubclavian and other arteries, round which the nerves twine in their courſe. The veins of the root of the neck and of the thorax are then to be injected from the jugular vein of the left ſide, the tube being pointed downwards. The integuments and pectoral muſcles being then raiſed from the breaſt, and folded over the ſhoulder, and the clavicle being alſo raiſed and held back—the ribs muſt be cut ſo far back as to allow eaſy acceſs to the right ſide of the cavity of the thorax. The lungs, too, of the ſame ſide muſt be lifted, and held over towards the left ſide, covering the heart.

To be regular in this diſſection, three ſtages may be obſerved: 1*ſt*, Thoſe nerves which lie upon the fore part of the neck, and proceed from the head; 2*dly*, The nerves which lie upon the ſide of the neck, viz. the origin of the phrenic nerve, and the nerves of the arm; and, 3*dly*, The courſe of thoſe three nerves, the par vagum, the ſympathetic, and the phrenic, through the thorax.

Nerves upon the fore part of the neck.—Diſſecting the maſtoid muſcle up from its origin at the clavicle, towards its inſertion, the carotid artery and jugular vein will be ſeen running up to that deep cavity under the angle of the jaw, which is filled up in part with the lower portion of the parotid gland, and forms the exit and entrance of the great veſſels of the brain. It is from this place that the greateſt number of important nerves proceed. Separating the internal jugular vein (A), and the common carotid artery (B), from each other, the par vagum, or eighth pair (1), will be ſeen lying in the ſame meſh of cellular membrane with theſe two veſſels. To find the sympathetic or intercostal nerve (2), it muſt be ſought for cloſe to the carotid artery, or rather below it, and betwixt it and the cellular membrane immediately covering the vertebræ of the neck. When theſe two nerves are followed up to the baſe of the ſkull, alongſt with the two great blood-veſſels, and under the belly of the biventer maxillæ inferioris, or digaſtricus (C), and the ſtyloid muſcles (D)—there are found ſeveral nerves coming out in company with them. The ninth pair (3) coming out makes a curve, and runs inwards to the tongue. From this conſiderable nerve there is ſent down a branch forwards (4); and hence called the descendens noni: and there will be found croſſing over the greater nerves, and over the carotid artery, a ſmall branch (5); but proceeding from under the jugular vein, derived from the cervical ganglion, high in the neck, it joins the deſcendens noni. From the root of the eighth pair there is ſent backwards a conſiderable branch, the accessorius (6); which running backwards, and joining with the cervicle nerves, is diſtributed to the muſcles upon the back of the neck. The eighth pair, too, gives off branches to the tongue and larynx, and adheres or communicates with the ganglion of the intercoſtal nerve: but theſe, in the preſent ſituation of the parts, cannot be ſeen without further diſſection. The ſympathetic, beſides being connected with the eighth pair, will likewiſe be found to be connected with the ninth pair, before it forms the upper ganglion. Theſe greater nerves, with their branches, come out at this part as if diſtinct nerves; for their connections are ſeen only by tracing them very far up towards the baſe of the ſkull. They may be here enumerated as diſtinct nerves. 1*ſt*, The par vagum (1). 2*d*, The ſympathetic, with its upper ganglion ſcarcely projecting (2, 2). 3*d*, The ninth pair (3), going to the tongue. 4*thly*, The deſcendens noni (4): and, 5*thly*, The acceſſory nerve (6).

Tracing the two more important nerves down betwixt the great artery and vein where they were firſt detected, the par vagum, or eighth pair (1), is found to ſend off ſeveral branches after reaching the

Sketch; serving as Notes for the Defsection of the Nerves of the Neck and Thorax



Etch. by Cha.s Bell

Aprile 1798 Publ.d for C Bell Edin.r

ſubclavian vein and artery. The moſt conſiderable of theſe turns cloſely round the ſubclavian artery (at 7), and returns upwards: On the left ſide, it turns round the great arch of the aorta. This is the RECURRENT NERVE, going to the back of the larynx and trachea; and, in its progreſs backwards, it may be ſought for again deep betwixt the carotid artery and trachea, upon the œſophagus (8). The œſophagus will be obſerved here to protrude to the right ſide from under the trachea. The ſmall branches of the eighth pair (9), which are ſent off nearly at the ſame time, may be traced alongſt the right branch of the ſuperior cava to the pericardium. Theſe can with difficulty be diſtinguiſhed from branches ſent off by the intercoſtal nerve, which take the ſame rout. The trunk of the eighth pair will be ſeen to deſcend into the thorax, betwixt the ſubclavian artery (E E) and the right branch of the vena cava (F), which is common to the jugular and ſubclavian vein.

Having traced the eighth pair in its courſe down the neck, expoſe the ſympathetic or intercoſtal (2) in the ſame manner, and raiſe it from its ſeat behind the carotid artery: trace it, or look for it, behind, and a little higher up than the ſubclavian artery, at the point at which the intercoſtal artery goes off. At this place will be found the ſecond or lower ganglion of the ſympathetic in the neck (15). Here it commonly ſplits upon the ſubclavian artery; but in this ſubject it ſplits upon the intervertebral artery. It joins again below it, and forms another ganglion (10), and at the ſame time proceeds into the thorax. From the firſt of theſe lower ganglions, branches are ſent to the ramifications of the trachea and heart and great veſſels.

NERVES UPON THE SIDE OF THE NECK.—The PHRENIC nerve lying upon the ſide of the neck may now be diſſected. The chief branches of the cervical nerves go backwards to the muſcles which pull back the head. Beſides a large branch backwards, the firſt cervical nerve communicates by delicate branches with the portio dura, and with branches of the fifth pair of the ſkull. The ſecond cervical nerve ſends a branch forwards to join the acceſſorius of the eighth pair. The branches derived from this union, and which are diſtributed to the integuments upon the fore part of the neck, platiſſima myoides, parotid gland, &c. muſt be deſtroyed in the firſt part of this diſſection.

The third cervical nerve (11.), ſending down a ſmall branch to the fourth cervical nerve (13), ſcarcely touching it, forms there a little knot. This being continued downwards (a branch of an inconſiderable ſize) and obliquely forwards, forms the the PHRENIC NERVE. The phrenic nerve dives into the thorax, betwixt the ſubclavian artery (E) and the ſubclavian vein (G). It there turns round to the ſubclavian vein; keeps cloſe to it (at F); and (at 14) is ſeen following the ſuperior cava round to the fore part, and before the root of the lungs, to the pericardium, alongſt which it is ſeen running down to the diaphragm, upon firſt lifting the ſternum (ſee Plate VI. l). Where it touches the diaphragm it ſinks into its ſubſtance (at 16), and ſeparates into many delicate branches, which accompany the diſtribution of the branching of the right phrenic artery;—a branch of which artery is reflected up upon the trunk of the nerve, where it lies upon the pericardium.

On examining theſe prolonged nerves altogether as they enter the thorax, the phrenic (14) is found running nearly parallel to the ſubclavian vein, and upon the fore part, where it lies oppoſite to the eighth pair.—The eighth pair, again, is upon the fore part of the ſubclavian artery; or betwixt it and the ſubclavian vein. The great ſympathetic, again, lies in its whole courſe cloſe to the vertebræ. Before proceeding into the thorax with theſe nerves, let us recapitulate the ſituation of the parts there, as laid out in this diſſection. The root of the lungs, i. e. the right branch of the trachea (H), and the pulmonic arteries and veins (I), are pulled towards the left ſide. Behind the branch of the trachea, and at the root of the veſſels going to the lungs, are ſeen a congeries of lymphatic glands (K K). Under theſe, again, the œſophagus (L) is ſeen deſcending through the thorax;—and immediately upon the ſpine, lower down in the thorax, the aorta (M) is ſeen paſſing down into the abdomen. The vena

azygos, or ſine pari, will alſo be found running up upon the ſpine, and making a curve forward (N) to join the ſuperior vena cava before it ſeparate into the ſubclavian veins. The bronchial arteries of this ſide may be ſeen turning round upon the right branch of the trachea and the intercoſtal arteries and veins, interſecting the ſpine at equal diſtances, and running into the interſtices of the ribs; where, after giving off twigs to the ſurrounding parts, the chief branch takes its courſe alongſt the groove upon the lower edge of each rib.

THE CONTINUATION OF THE NERVES INTO THE THORAX.—The eighth pair, holding a direct courſe betwixt the ſubclavian vein and artery, keeps behind the ſuperior vena cava (F), and paſſes under the curvature of the vena azygos (N); then dividing, it ſends numerous branches to the lungs (17—17); and the chief trunk dividing and rejoining, covers the ſide of the œſophagus. If the lungs were allowed to fall to their place again, theſe diviſions of the eighth pair would lie behind the œſophagus. The nerves of each ſide communicate by branches as they lie upon the œſophagus. Having paſſed through the thorax (at 18), and perforated the diaphragm, the eighth pair is diſtributed to the ſtomach; and joining with the eighth pair of the left ſide, they are loſt in the great ſemilunar ganglion.

To find the SYMPATHETIC or INTERCOSTAL NERVE coming down into the thorax, we look up from the cavity of the breaſt under the ſubclavian vein and artery; and upon the joining of the firſt rib with the ſpine, we ſee its ganglion (10), which it forms after twiſting its fibres round the ſubclavian artery and intervertebral artery, continued and enlarged by the addition of the intercoſtal nerves. To trace its progreſs in the thorax, the ribs (o o o) muſt be cut down, and the diaphragm ſeparated from its connections with them, and held out attached to the ſpine; and then the courſe of its continued trunk (19) over the heads of the ribs may be obſerved; and alſo its anterior branch, which is formed by ſlips (20) ſent forward over the ſides of the vertebræ, and continued parallel to the aorta. If it is found inconvenient to continue the diſſection of the intercoſtal nerve in this ſituation of the parts, it muſt be deferred until the thorax is freed from the heart and lungs, and until the veins (A F G) be taken away. The ſubclavian artery (E) is to be cut from its trunk, and left with the intervertebral artery. Then the pleura being diſſected off, the intercoſtal nerve is found communicating with each of the dorſal nerves by a ſmall triangular cuſhion-like ganglion (21). The proper intercoſtal branches of the ſpinal nerves (22) ſhould be diſſected, and held out, as they go backwards through the ſpace betwixt the ribs: and the formation of the anterior branch of the ſympathetic by the ſlips ſhot out from the ganglions, and lying cloſe to the ſide of the ſpine, ſhould be carefully diſſected, and this branch followed to its paſſage through the appendix muſculoſa of the diaphragm.

GENERAL VIEW OF THE ACTION OF THE VASCULAR SYSTEM, AND OF THE ACTION OF THE DIAPHRAGM AS AFFECTING THE HEART;—BEING INTRODUCTORY TO THE DISEASES OF THE HEART AND VESSELS.

THERE are a few leading points in the action of the vaſcular ſyſtem, which being acknowledged and kept in view, will enable us to examine with advantage the morbid appearances in the heart and adjacent veſſels; or their preternatural ſtructure, as in monſters, or in the imperfect animals. And as the appearances which we have to expect in morbid diſſection are perpetually varying, to proceed at once to a detail of thoſe appearances, without ſettling the principles upon which our eſtimation of their import-

ance is to be formed, muſt expoſe us to continual difficulties. It is neceſſary to recollect the ſituation of the heart in relation to the ſurrounding parts, and to conſider how its motions are regulated.

But the ſituation of the heart and lungs, with the connections of the diaphragm and mediaſtinum, having been already deſcribed, it remains only to conſider their action. When the diaphragm, which divides the thorax from the abdomen, is pulled down, and the thorax is expanded, and the lungs conſequently dilated, it is natural to inquire, What effect this expanſion will have upon the heart, or at leaſt upon the great veins and auricles? As they lie within the ſame cavity with the lungs, they alſo would be dilated, or their action in ſome meaſure affected, by the vacuum * thus formed in the thorax, were there not a particular mechaniſm to counteract it. By the connection of the mediaſtinumwith the heart, by its reaching to the upper part of the thorax and ſurrounding the great veſſels, and by its being ſtretched over the pericardium, or rather intimately connected with it, and forming its outer coat—it embraces the whole circulating powers in the thorax. By this means the heart is ſo ſituated, that the effects of that dilatation of the cavities, by which the lungs are dilated, is counteracted in its operation upon the heart and veſſels:—for the mediaſtinum, being connnected firmly with the diaphragm, the diaphragm contracts only upon its lateral parts, while its efforts upon the mediaſtinum muſt pull the membranes cloſer about the heart, in proportion to the increaſe of capacity of the thorax, and to the tendency which the heart would otherwiſe have, in conſequence of that increaſe, to dilate. This may ſerve as ſome explanation of the heavings of the cheſt, when, by violent exerciſe, or in any other way, the blood is ſent into the right ſide of the heart in increaſed quantity: for while an increaſe of velocity in the circulation of the blood requires a proportional increaſe in the action of the lungs, the compreſſion of the heart and veſſels, when the diaphragm acts ſtrongly upon the mediaſtinum and pericardium, makes us inſtinctively ſtruggle to procure the neceſſary dilatation rather by the expanſion of the ribs than by the action of the diaphragm. If the lungs are thus dilated by the expanſion of the thorax, then the diaphragm does not need to be ſo violently contracted, and conſequently the pericardium and mediaſtinum do not ſo ſtrongly compreſs the heart, veins, and right ſinus. An increaſe of the velocity of the blood in circulation muſt be accompanied with a proportional increaſed action in the lungs, becauſe this increaſe of the quantity or velocity of the blood paſſing through the heart, is an increaſe of its ſtimulus, which muſt be accompanied with a proportional increaſe of the power of action or irritability; the ſource of which is in the lungs, and which, through the medium of the blood, is beſtowed upon the heart. Were not the heart thus invigorated to greater action, an increaſed flow of blood through it would exhauſt its powers, and a load of blood be forced into its cavities, which it would be unable to propel forward; as happens in experiments upon the lungs of animals when the artificial breathing is ſtopped †.

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* It will not be underſtood that I mean here a ſeparation betwixt the lungs and the inſide of the thorax and an actual vacuum, but ſimply the tendency which the dilatation of the thorax has to expand any cyſt whoſe cavities can be filled from ſources external to the thorax; as the lungs, by the atmoſpheric air drawn through the trachea; or the heart, by the blood drawn from the extremities of the ſyſtem.

† It is ſaid, that the blood, as a local ſtimulus, could not produce that regularity which the heart has in health, nor that irregularity which we find in diſeaſe. But the blood affects the heart in two ways;—firſt, by ſtimulating it to exertion, in conſequence of the mere diſtention of its cavities;—and, again, by beſtowing upon it, in its circulation through the coronary veſſels (as in every other part of the body), life and the principle of activity. For when blood unventilated, unimpregnated with new properties (or whatever action the lungs produce upon it), gets acceſs to the coronary veſſels, it more quickly diſſipates the energy of the heart than if the heart were allowed to exhauſt itſelf, deprived of all circulation. It is of conſequence to obſerve the appearance of the blood circulating in the coronary veſſels in experiments upon the action of the heart in living animals. This is not a matter foreign to the preſent ſubject; it is impoſſible to account for the way in which the blood is found diſtributed in the ſyſtem after death without conſidering it.

But to return, this mechaniſm in the thorax brings the great veſſels in the breaſt more to a balance with thoſe in the belly, and other parts of the body.

Upon examining the ſituation and connection of the ſuperior and inferior cava, it is evident that they are not ſo large, in proportion to the arteries, as the veins in other parts of the body are; and that the blood muſt conſequently paſs through them with greater force or celerity, ſince the diameter of the veins, compared with that of the arteries, muſt be the meaſurement of the comparative force with which the blood paſſes through them. At the bottom of the jugular veins, and at the mouth of the axillary or ſubclavian veins *, we find valves placed, which defend them, as they enter the thorax, againſt the regurgitation of the blood from the cheſt into the upper extremities and head, when the contents of the cheſt may (in conſequence of any irregular action peculiar to the reſpiratory organs, as coughing or ſneezing) be under ſeverer preſſure than the veins in the extremities †. That it is not to prevent the back ſtroke of the auricle that theſe veins are guarded by valves, we may preſume; ſince there are no valves guarding the pulmonic veins from the action of the left auricle, and ſince there are no valves in the lower cava. This laſt circumſtance ſuggeſts to us the probability that in every irregular motion in the action of reſpiration, the compreſſion upon the veſſels is the ſame in the abdomen as in the thorax; for if there were a poſſibility of a greater compreſſion in the thorax by any voluntary exertion of the body, or irregularity of reſpiration, the lower cava would have been defended likewiſe with valves. And it will appear, from a review of the action of the abdominal muſcles and diaphragm, that the veins in the thorax and abdomen do in all actions ſuffer like degrees of compreſſion. Let it be conſidered for a moment, what would be the conſequence upon the viſcera of the abdomen, if, during a fit of coughing, their veſſels were liable to as violent diſtention as we ſometimes ſee in thoſe of the face. That the compreſſion upon the veſſels of the thorax, and upon thoſe of the abdomen, is the ſame, will further appear from this conſideration, that when the abdominal muſcles act ſtrongly, the diaphragm yields, which prevents the greater compreſſion of the abdominal viſcera. On the contrary, when the diaphragm reacts and reſiſts, then the force reſiſting (viz. the diaphragm) being equal to the force firſt exerted by the action of the abdominal muſcles, it follows, that the portion of the cava which is in the thorax is as ſtrictly compreſſed by the mediaſtinum as the cava in the lower belly is by the abdominal muſcles. Again, if the diaphragm acting ſhould be ſuppoſed to compreſs the veſſels round the heart, it muſt be remembered, that its contraction pulls ſtrongly upon its origin, or inſertion, only according to the reſiſtance which its action meets with: and as the mediaſtinum may almoſt be conſidered as the inſertion of this muſcle, if the abdominal muſcles do not react, the mediaſtinum cannot be ſtrongly compreſſed, and the abdominal muſcles when they do react compreſs the lower cava with an equivalent force.

If the preſſure were not equal in the breaſt and in the belly, but greater in the breaſt, then would the blood be occaſionally repelled from the breaſt, and accumulated in the abdomen ‡.

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* In Plate VI. there are two etchings of the veins at this part. Fig. 2d ſhows the natural dilatation of the internal jugular vein above the valve. Are we to conſider this dilatation in the great veins of the neck as a proviſion againſt congeſtion in the head from any irregularity in the circulation of the cheſt, and as admitting a kind of depoſite here of that blood which would ſtill more ſubject the head to the load of repelled blood during violent coughing, &c.? In violent fits of coughing, the contents of the breaſt are under violent compreſſion during the convulſive expiration; but preparatory to that convulſive expiration, and after it, the maſtoid muſcle is in violent action as a muſcle dilating the cheſt, the head being fixed, and muſt compreſs this dilated vein which lies immediately under it; and as the blood in the vein cannot enter the head again, it is forced into the ſuperior cava. See further of the veins of the abdomen in this action, note ‡, below.

† In diſſecting ſubjects in which there are enlargements of the heart, or where palpitations of the veins of the neck have formed a ſymptom of this diſeaſe, and where the pericardium is found dilated, &c.;—it is of conſequence to examine the ſtate of relaxation of the diaphragm, the valves of the veins in the neck, the valves in the heart, and the general relaxed ſtate of the membranes in the thorax, as explaining the ſymptoms of the diſeaſe during life.

‡ In violent coughing, ſtraining, ſneezing, &c. wherever, in ſhort, the thoracic and abdominal muſcles are exerted, ſtagnation is ſaid to be produced in the veins near the thorax. This, it may be obſerved, can never be brought directly to the teſt of experi-

It comes next to be conſidered, What is the power which dilates the auricle; and what is the conſequence of the action of the auricle upon the column of blood in the veins? The great uſe of the auricle is, to prevent the action of the ventricle upon the circle of blood contained in the veſſels from propelling the blood round upon the ventricle, even whilſt yet in its ſtate of contraction. For when the ventricle contracts, it throws forward into the veins a quantity of blood beſides what dilates the arteries; and a portion of the column of blood in the veins neareſt the heart is conſequently driven forward and fills the auricle *. That the dilatation of the arteries is not ſufficient to account for the quantity of blood ſent out by the contraction of the ventricle, is apparent from the flow of blood being continued in the veins during the contraction of the heart and dilatation of the arteries:—and that quantity of blood which is more than ſufficient to dilate the arteries and continues to flow into the veins, would, it is evident, diſtend the ſides of the veins, were not the auricle at this time relaxed ſo as to allow an eaſy exit from the veins of this addition to their column of blood. This free exit to the venal blood, in the direction of the axis of the veins, prevents an additional lateral preſſure.

It is perhaps more difficult to explain why there is not a regurgitation of the blood, or dilatation of the veins, upon the reaction of the auricle. For though the force and quantity of the blood ſent from the ventricle be ſo much more than ſufficient to keep the veins dilated to their ſtationary diameter as to dilate the auricle alſo, there is ſtill to be accounted for that portion of the blood delivered by the ventricle which was ſufficient to fill the arteries, and which continues to be forced on during the contraction of the auricle.

The queſtion comes ſimply to this, At what time, or by what power, does this quantity of blood, which is ſent out by the ventricle, and which is more than ſufficient to dilate the auricle, and ſtimulate it to contraction, return to the ventricle? Does the blood, even during the contraction of the auricle, ſtill force itſelf onward by the effort of the arteries to contract, not in oppoſition to the contracting auricle, but acting, in aid of the auricle, to diſtend the relaxed ventricle? Or does the quantity of blood, which is by the contraction of the arteries propelled into the veins, diſtend the veins through the whole body during the contraction of the auricle, and when the blood may be ſtopped from entering the heart? The firſt of theſe ſeems to be the truth;—becauſe, by ſuppoſing the contraction of the arteries ſtill to carry forward the column of blood in the veins ſo as to flow through the auricle into the relaxing ventricle, the whole quantity of blood ſent out from the ventricle is accounted for without any pauſe or ſtop in the whole circulation †. This ſeems to agree the beſt with our obſervations on living animals: and it accounts for the lateral preſſure of blood upon the ſides of the veins being at all times

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ment, unleſs in the veins of the neck; becauſe theſe actions cannot be produced when the breaſt of an animal is laid open. The opinion has ariſen from ſeeing people coughing violently with their face turgid with blood; but this is cauſed by the difference of compreſſion in the thorax, and in the head and arms, and does not prove that there is any difference of compreſſion in the belly and in the breaſt. And the greater turgidity of the face to that of the arms is probably occaſioned, partly by the action of the muſcles of the neck (chiefly by that of the platyſma myoides, which covers the external jugular vein, and is in violent ſpaſmodic-like contraction during violent coughing), and partly becauſe any dilatation of the veſſels of the head muſt be external only.

* In examining monſters, and in diſſecting the more imperfect animals, the great principle which muſt keep the blood in an uninterrupted circulation ought to be remembered, viz. the alternate action and relaxation of the muſcular fibres of the arteries; their elaſtic power being only ſubſervient in reſiſting, and in throwing the contraction of one ſet of muſcular fibres upon that which is to follow, that it may be dilated, and again in its turn react. An artery cannot circulate the blood either in a monſter or a worm without ſome part of the circle alternating with it in action and relaxation.

† From obſervations on the heart's motions in living animals, when influenced by artificial breathing, Mr Hunter concludes, "That the auricles are only reſervoirs, capable of holding a much larger quantity than is neceſſary for filling the ventricles at one "time, in order that the ventricles may always have blood ready to fill them." This is the opinion which is careleſsly adopted in all books in which any explanation is given of this. But it is perfectly clear, that ſince there is a quantity of blood ſent out from the ventricles ſufficient to dilate the arteries as well as the auricle, there muſt, upon the relaxation of the ventricle and action of the auricle be a quantity of blood equal to that which dilated the veſſels returned into the ventricle, beſides what is ſupplied by the auricle; and the contraction of the auricle cannot from its own ſtores ſufficiently dilate the ventricle, without there being in the next round of actions a deficiency of blood ſent by the auricle into the ventricle.

equal. And if the combined power of the arteries cannot force a portion of the column of blood, equal to their contraction, into the ventricle during the contraction of the auricle, then not only muſt it be allowed that the contraction of the auricle is ſtronger than that of the arteries, but that it is ſo even when its whole ſide is as if opened by the relaxation of the ventricle. It is evident, then, that the relaxed ventricle is the only oppoſition to the flow of the blood from the veins into the heart during the contraction of the auricle. Were we to account for the quantity of blood ſent out by the ventricle, by ſuppoſing a dilatation of the veins to take place, we muſt allow a ſtoppage, or retrograde movement, in the great veins, which is contrary to the facts every day before us: and beſides, this ſuppoſed dilatation of the veins (which may be imperceptible, being ſo ſmall a quantity of blood diffuſed over the whole body), muſt be accompanied by a greater compreſſion upon the blood of the veins at one time than at another; which ſhould be eaſily obſerved.

But the conſideration which puts this queſtion of the action of the veins in its trueſt light, is this: The power of an artery is great in proportion to its length; and this increaſe of power, which the artery gains as it recedes from the heart, is thus exactly proportioned to the diſtance through which it has to propel the blood back by the veins. In this way all the veins (whether the coronary vein of the heart, or the cava of the body) pour their blood with an equal force into the auricle. An action of the veins, on the contrary, would not be thus counteracted; but the blood would flow to the heart with unequal force, according to the length of the vein which acted upon it.

It may be well to conſider, how very ſmall any dilatation of the veins, occaſioned by ſuch an inſufficient cauſe as is generally aſſigned, muſt be; and the inveſtigation will at the ſame time take away from the ſupport which might be derived to the above opinion from the obſervations of thoſe who have ſeen even violent pulſation in the veins, and conceived it to be occaſioned by the action of the ventricle, and to be ſynchronous with the pulſation of the arteries*. The pulſation in the arteries is occaſioned by the whole quantity of blood ſent through them, in the direction of their axes, lengthening them, in oppoſition to their elaſticity, and cauſing them to form contortions or curves. This is well illuſtrated in the pulſation of the heart; which is in fact the pulſation of the aorta, not of the heart, and is cauſed by the effort of the aorta to lengthen itſelf, and to form a more direct line, carrying the heart as on its point. It is illuſtrated alſo by the contortions of the arteries of living animals; as in the membranes of the chick in ovo:—and it gains additional proof from conſidering the very ſmall dilatation which an artery muſt ſuffer in any one point touched by the finger, though the dilatation of the whole taken together is conſiderable. It is not, therefore, the degree of dilatation which we feel in the pulſe, but the ſhock given to the column of blood by the action of the ventricle. Before adopting the opinion, then, that the reaction of the arteries ſhould perceptibly dilate the veins, or convey a pulſation to them, it muſt be remembered, that the veins, either during the contraction of the heart, or during that of the arteries, do not receive the impulſe of the ſame quantity of blood which gives the pulſation to the arteries; but if they ſhould be ſuppoſed to dilate during the contraction of the arteries, they receive only that which

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* Mr Hunter ſays, "I think I have ſeen the difference of the projection ſo great, that it hardly could ariſe from that cauſe "alone;" viz. the lateral dilatation of the accompanying arteries.—And he adds, "The large veins near the heart have a pul- "ſation, which ariſes from the contraction of the heart preventing the entrance of the blood at that time, and producing a ſtag- "nation. This I ſaw in a dog, &c." The inconſiſtency of this is evident. He finds a dilatation of the veins ſynchronous with the dilatation of the arteries, viz. by the contraction of the ventricle; and, again, when they ſhould unload themſelves of this blood which dilates them, they are precluded by the action of the heart preventing the entrance of the blood, and forming a ſtagnation. And in oppoſition to both theſe obſervations, he ſays in the ſame page, that in ſome fevers the arteries contract and the veins dilate alternately. Having an unſettled wavering opinion, he makes obſervations in direct contradiction. All obſervations in experiments upon the dilatation of the vena cava near the heart, the effect of artificial breathing on the action of the heart, and ſtagnation of the blood by expiration, are inaccurate;—for by the opening of the breaſt the whole actions in the thorax muſt be completely deranged.

is ſpent in the dilatation of the arteries; and if they are ſuppoſed to be dilated during the contraction of the heart, then are they dilated by the blood ſent from the ventricle which remains after the dilatation both of the arteries and auricle. To all this muſt be added the very great difference of capacity of the veins and arteries;—that many veins of a greater ſize accompany a ſingle artery in the extremities; and how immenſe the capacity of the veins is in many parts of the body; as the ſinuſes of the head, the great veins in the neck, abdomen, and pelvis. How little effect that quantity of blood which dilates an artery (in a degree imperceptible to the ſight) ſhould have when thus diſperſed in the greater capacity of thoſe veins, which is triple, or even quadruple, that of their accompanying arteries, muſt be at once acknowledged.

But further, a pulſation, ſuppoſed to be tranſmitted to the veins, would differ from that given to the arteries, in this—The pulſation of the arteries is great near the heart, becauſe their elaſtic reſiſtance is great, and the force of the current of blood ſent forth from the heart is propelled violently in a narrow channel: And the elaſtic reſiſtance of thoſe greater arteries throws the force of the blood forwards unexpended into the ſmaller arteries, which have a leſs degree of reſiſting elaſticity, and a diameter (the caliber of their branches being taken collectively) infinitely greater than the trunks:—and as thoſe branches have, as they recede from the heart, an additional muſcular force in proportion to the loſs of their elaſtic reſiſtance, which muſcular power is then in a ſtate of relaxation, that portion of the blood which is expended upon the dilatation of the arteries is beſtowed upon their extremities chiefly; and the extreme arteries again react by their muſcular power in exact proportion to their degree of dilatation—and thus they become the moſt active agents in the circulation. But if the great arteries near the heart were dilatable in a great degree, it would retard the circulation; becauſe the force of the ventricle would be expended upon their dilatation, where there was no need for it, ſince the dilatation is a proviſion for an additional muſcular power, to be exerted in accelerating the motion of the blood. We ſee, then, that the arteries dilate as they proceed; that they form a cone with its apex in the heart; that the blood muſt move more ſlowly onward in the extremities; and that it loſes in a proportional degree its impulſe from the heart. The effect of the contraction of the arteries, then, upon the veins differs from that of the heart upon the arteries, in this, That the effort of the heart is accumulated to a point, and the whole blood of the body is propelled through a narrow channel; that the contraction of the extremities of the arteries, on the other hand, although great when taken in its combined effect, yet being diffuſed over the whole body, and the action upon the veins being through their innumerable extremities, and the quantity of blood returned by the veins, during the impulſe of the heart, not being equal to that which paſſes through the aorta, the blood in its paſſage through the veins cannot have the ſame effect in cauſing a pulſation with the current of blood through the aorta.

Thoſe who conceive that there is a pulſation in the veins, and who argue from what they have obſerved of the beating of the veins, or the leaping of the blood from them when punctured, as from an artery, beſides overlooking the effect of the alternate action of the heart and arteries (ſee p. 24.), do not ſeem to have conſidered what the effect of this great degree of action in the veins of the whole body would have upon their inſertion into the right ſide of the heart: for perceptibly to dilate the veins, would take a quantity of blood greater than is ſufficient to dilate the auricle; while, by their account, this pulſation is occaſioned by the ſame power which cauſes the pulſation of the arteries, viz. the ventricle. Now this is the ſame with ſaying, that the contraction of the right ventricle of the heart dilates the arteries, dilates the veins, and fills the auricle; and in this ſtate the quantity of blood delivered from the heart is left, without accounting for the manner in which an equal quantity of blood with that which fills the arteries and veins returns to the ventricle from which it was propelled. When are the veins ſuppoſed in this caſe to be emptied? It muſt be during the contraction, not only of the auricle when the exit of the blood is more difficult, or, as the greateſt ſupporters of this opinion ſay, is

abſolutely ſtopped; but alſo during the contraction of the arteries upon the other extremity of the veins, which probably produces a greater effect upon them than even the action of the heart, which is more remote.

The moſt eſſential difference between the veins and arteries conſiſts in the different velocity of their blood. The quantity of blood under the active influence of the heart and arteries, at the ſame moment, is amazingly ſmall compared with that in the veins: but in any length of time, the quantity paſſing through the arteries will be equal to that paſſing through the veins; for the veins have the blood ſlowly moving in their large cavities, while in the arteries it is ſent quickly through their narrow channels. The blood in the veins approaching the heart, is received as into a vortex, puſhed in an inſtant through the right ſide of the heart, driven through the circulation of the lungs, has its properties invigorated, and in an inſtant is ſent through the whole body, comes in contact with the parts upon which it is to act, is again depoſited in the veins, where for a time it lies inactive, or ſluggiſhly moving through their dilated cavities. If it were not for this diſtribution, and if the heart and arteries could not draw ſupplies from the more inert maſs of blood in the veins, our lives would be ſtill more liable to every accident, and a trifling loſs of blood would be fatal. It may be of importance to conſider, as connected with the animal economy, from what proceeds, or to what tends, the increaſed quantity of blood in the dilated veins of old people, and whether it correſponds with the deminiſhed velocity of the pulſe, &c.

From the nature of the ſubject, this account may appear prolix or confuſed. In the apparent ſimplicity of the heart's motions, there muſt be many actions in uniſon with each other, while yet in deſcription it is difficult to convey an idea of the accuracy with which every action is adapted to that which is to follow. But it may be uſeful, in concluding this ſubject, to give a ſhort recapitulation of the mutual action of the heart and blood-veſſels.

The contraction of the ventricle delivers into the artery a maſs of blood, which quickly pervades the rigid trunks, and is ſent into the more pliant muſcular extremities, which are then in relaxation. Theſe arteries dilate through their whole length, but chiefly in their ſmall branches. Beſides the quantity of blood dilating theſe arteries, there is enough ſent from the ventricle of the heart to continue the propulſion of the blood into the veins, which diſplacing a proportional quantity from thoſe veins which lie near the heart, propels it into the auricle, and dilates it. By this means the auricle is dilating during the contraction of the ventricle: again, upon the relaxation of the ventricle from its action, the flow of blood is continued into the veins by another power, viz. the contraction of the arteries. By this contraction, the quantity of blood ſent out by the laſt pulſation, more than was ſufficient to fill the auricle, is continued forward with great force; a force as great as that exerted by the auricle: It conſequently enters the relaxed ventricle alongſt with that blood which is ſent in by the contracting auricle; and ſo a maſs of blood, equal to that ſent out by the laſt pulſation of the heart, is ſent again into the ventricle. The flow of the blood through the inoſculating branches of the arteries and veins (which muſt be conſidered as the ultimate intention of the circulation) is ſlow and uniform, allowing a reciprocal action betwixt the fluids and ſolids; and is yet ſent to the heart in ſuch a manner, that the alternate action of the muſcular power, the efficient cauſe of the circulation, is at one time allowed relaxation, and is at another ſtimulated to action.

See Peculiarities in the Veſſels of the Extremities in the next Part, containing the Diſſections of the Thigh, &c.

OF THE APPEARANCES OF DISEASE IN THE CIRCULATING SYSTEM.

Although, during life, the heart ſeems the moſt frequent ſeat of diſeaſe, the moſt diſtreſſing ſymptoms, and all the feelings of miſery and opreſſion ſeeming to be concentrated there; yet organic diſeaſes, or ſuch derangement of the natural ſtructure as comes under examination in the dead body, are far from being common. This is to be aſcribed to the more lively ſenſibility of the heart, and its ſtrict dependence upon the reciprocal actions of the whole ſyſtem: ſo that while the feeling of diſeaſe in the heart is common almoſt to a neceſſity in every more univerſal diſeaſe, its organic derangements are comparatively few.

OF THE APPEARANCE OF DISEASE IN THE COATS OF BLOOD-VESSELS.

Both arteries and veins are ſubject to have concretions formed in their coats; but in the veins it is an uncommon diſeaſe; and, apparently, the concretions are different in every reſpect from thoſe found in the coats of arteries. Concretions in the arteries have been long a ſubject of inquiry; and it is one which indeed involves much matter of practical importance in its diſcuſſion.

Of concretions.—Puſhed on by the ſucceſs of ſome experiments upon the generation of bone, I applied with keenneſs to every opportunity of examining morbid concretions in the coats of arteries; and although I came to no new concluſions with regard to their formation, I was confirmed in the opinion that, in accounting for dilatations in arteries, too much importance has been given to concretions, while the general ſtate of the artery has been overlooked; and that concretions are more of an accompanying evil, and only one of many forms which diſeaſed arteries aſſume. Theſe concretions are ſituated betwixt the inner membranes of arteries and their muſcular coat. They are of two kinds. More generally they appear upon the inſide of the artery yellow and irregularly concreted tubercles; and upon the injection and drying of the artery, they raiſe its ſurface into irregularities, as in Plate IX. fig. I. It is in this ſtate that, upon opening them, they are frequently found ſurrounded with matter, thick, and of the ſame colour with the concretions. This led Haller to the explanation, that theſe oſſifications, as they are commonly called, are concreted from a fluid matter depoſited; in oppoſition to the opinion, that the matter is formed in the ſurrounding coats by the irritation of this foreign ſubſtance cauſing ulceration. Were this fluid matter produced by ulceration, we could not conceive that the artery ſhould be able to ſuſtain the force of the blood for an inſtant, or what limits ſhould be ſet to the ulceration. Theſe opacities are often ſeen without any concretion.

This matter ſurrounding the concretions was obſerved by the older anatomiſts; but was conſidered rather as a circumſtance confirming them in their opinion of the concretions being true bone; for this they conſidered as the marrow.

In the broad ſcales, which more reſemble bone, this fluid matter is ſeldomer found. Such broad ſcales are frequently found almoſt completely ſurrounding the artery (as in Plate IX. fig. VII. and V.), without any dilatation or aneuriſmal enlargement of the artery; while the more irregular tubercles are common in the enlarged arteries, as in fig. I.

Rupture from the ſcales formed in the coats of arteries happens very ſeldom in the great arteries of the trunk. From the caſes on record, it would appear, that the fair rupture of the aorta takes place more frequently within the pericardium, and at the root of the heart.

It is wonderful that the larger trunks of arteries, where they lie in an even courſe, are ſometimes ſurrounded with ſcales of theſe concretions, while yet they ſeem to perform their functions. In fig. III.

we have an example of a ſcale taken from the bifurcation of the aorta; which, from having been allowed to dry, appears here more intimately blended with the coats of the veſſel than it really was. Oſſifications in the lower part of the aorta are very frequent without dilatation. In fig. V. 4. many very broad ſcales are ſeen in the femoral artery, without any dilatation; and alſo in fig. VII. which is a remarkable oſſification of the ſplenic artery. Theſe inſtances would alone teach us how paſſive the great trunks of arteries are, compared with the extreme branches.

Of the cause of aneurisms.—In aneuriſms of the great arteries, the coats are found thickened, firm, and eaſily ſeparating into layers, almoſt conſtantly with concretions formed in them, and with their elaſticity always remarkably diminiſhed. Theſe oſſifications have been always aſſigned as the cauſe of enlargements of the arteries; but the degree of the enlargement, and its place in the artery, do not ſeem affected by the oſſifications. If theſe oſſifications cauſed the enlargement of the artery, by acting mechanically by attrition and deſtruction of its coats, they would produce, not a gradual and extenſive enlargement, but a partial and ſudden one; ſuch as we find in the extremities. It has been ſaid, that the oſſifications in the coats of arteries occaſion greater reſiſtance to the dilatation cauſed by the action of the ventricle of the heart; and that this reſiſtance exciting the heart to greater action, it becomes at laſt ſo great as forcibly to dilate the artery.—A ſtrange ſubtility, to make the ſtrength of the artery the cauſe of its being overpowered. It is ſaid again, that theſe oſſifications deſtroy the muſcular coat of the artery; and, conſequently, rendering it incapable of withſtanding the ſtroke of the heart, it ceaſes to ſecond the ſtroke of the heart, and ſuffers itſelf to be dilated. But the muſcular coat of an artery is not that which reſiſts the paſſage of the blood, or rather the dilatation occaſioned by the force of the ventricle; the muſcular coat is alternate in its action with the heart. During the contraction of the heart it is in relaxation; and it is only when the heart intermits its action that the muſcularity of the greater arteries acts in reſiſtance to the muſcularity of the extremities; whoſe combined power would repel the blood back to the trunks, and dilate them, were the greater trunks not enabled to reſiſt by the additional action of their muſcular power. The great power of reſiſtance in the arteries near the heart to the blood propelled from the ventricle, is their elaſticity. This is a power which yields, yet reſiſts. By its yielding, and yet its uniform encreaſing reſiſtance even to the utmoſt ſtretch of its elaſticity, it ſubdues that ſhock which the great veſſels would otherwiſe receive from the ſudden exertion of the heart. Upon diſſecting the coats of dilated arteries, it is apparent, that the whole functions of the veſſel muſt be impaired; the coats are thickened; are eaſily diviſible; and have loſt their elaſticity. And upon examining the length of the aorta, when thus diſeaſed, it is found dilated; not uniformly where the oſſifications are moſt numerous or longeſt, but often where there are no hardenings or concretions in the coats. On the other hand, whole tracts of oſſification will be found without any dilatation of the artery. In this ſtate, the arteries can no longer dilate upon the action of the heart, and uniformly reſiſt and contract again; but, on the contrary, there is a more ſolid and inert reſiſtance to the impulſe of the heart, their coats being thick and unelaſtic: ſo that every contraction of the heart gains a point in the dilatation of the artery, which (unlike the dilatation of elaſticity) is never regained. Thus, although the artery be actually ſtrong in its coats, and dilated and filled with firm coagula of blood, yet will the impulſe of the heart gradually encroach upon this inert reſiſtance.

Cause of dilatations being more frequent in the curvatures of arteries.—The arteries are more generally dilated at their curvatures, or where branches are ſent off. The reaſon of this is evident, if we allow the above explanation of the cauſe of dilatation in general. Thoſe who have paid minute attention to the ſtructure of arteries, have found, that where an artery ſends off a branch, or takes a ſudden turn, its coats are ſtrengthened to reſiſt the action of the blood, which muſt be greater at theſe

points: and as this increaſe of ſtrength muſt conſiſt in a more powerful elaſtic and pliant reſiſtance to the current of blood propelled by the heart, combined with ſuch a proportion of muſcular power as to react equally with the reſt of the canal; ſo when the coats of the artery become diſeaſed, they bring the artery to the ſtate of a rigid tube; and, conſequently, the force of the heart becomes more quickly perceptible at thoſe points which are moſt expoſed to the current of the blood, and where that power which formerly reſiſted in a greater degree is now reduced to the ſame ſtate of inactivity with the reſt of the tube. Thus we find dilatations more frequent in the curvature of the aorta, at the root of the great veſſels going to the head and arms; and in the belly, at the cœliac and emulgent and meſenteric arteries.

Of aneurisms in the extremities.—This explanation of the cauſe of dilatation may be extended to the aneuriſms of the arteries in the extremities; where we almoſt conſtantly find the enlargement of the artery at the part where it lies in the great joints, as in the groin or ham. But in the aneuriſms of the extremities there is often another cauſe of dilatation, which ariſes from the mechanical effect of the concretions in the coats. In diſſecting the tumor of the artery, it is frequently found, not to be a uniform dilatation of the coats of the veſſel, but the artery is ſeen upon one ſide of the tumor *, and reſembles that aneuriſm which is formed by the puncture of the veſſel, and by the blood eſcaping from it into the ſurrounding ſoft parts, and forming a ſac. Wherever I have had an opportunity of examining the artery, it was much oſſified and diſeaſed above the tumor; a circumſtance always to be dreaded in attempting the operation when it is an aneuriſm of the dilated coats.

Theſe concretions in the coats form gradually; and they adapt themſelves to the ſhape of the artery in the prevailing poſture of the limb. If the leg be for the moſt part ſtiff and rigidly extended, upon any violent exertion the artery is bent, and its coats torn upon the edges of theſe concretions. On the other hand, if the limb be ſhrunk up and contracted, the artery being at the ſame time diſeaſed in much of its extent, may have formed a ſcaly concretion in a curve anſwering to the bend of the artery at the joint, as in the ham or groin; and in this caſe a violent attempt to ſtretch the leg will have the ſame effect, ſince it muſt bring the artery to an angle differing from that of the ſcale which has been formed in its coats, and ſo rupture it. There are caſes of this kind upon record.

More particularly of the great aneurisms in the breast.—While ſlight dilatations are very frequent in the aorta, as it proceeds from the heart, and in its great arch, it is univerſally obſerved, that dilatation of the pulmonic artery is very rare. When the dilatation of the aorta has proceeded a certain length, it rapidly encreaſes. The drawing of the aorta which is given in Plate IX. fig. I. may be conſidered as the firſt ſtage of its dilatation, and is a common appearance. It ſeldom happens that the artery is in this condition near the heart, without being in ſome degree enlarged through the whole length of the aorta. Aneuriſm never is in its commencement a local diſeaſe. But when the dilatation of the artery has proceeded thus far, it generally at ſome one point gives way more eaſily; ſo that the dilated ſides of the artery are puſhed towards the root of the neck, or being forced directly forward in the cheſt, come in contact with the ſternum. The bone for ſome time interrupts its progreſs: but by the continued impulſe from the heart, the coats of the artery ſeem to be worn away in the pulſation againſt the bone: while, on the other hand, the pereoſteum and membranes which cover the bone are entirely deſtroyed, and the bone itſelf becomes carious. Or ſometimes the dilated ſac of the artery, ſtretching widely under the ſternum, finds a leſs reſiſting paſſage betwixt the cartilages of the ribs, deſtroys their membranes, and, protruding, raiſes a beating tumor externally upon the breaſt. When this happens,

* See Veſſels of the Thigh.

there are generally two tumors; the tumor of the one ſide appears before that of the other, and commonly they riſe upon each ſide of the ſternum, about a hand's-breadth below the clavicle.

To examine the ſtate of the parts, we may proceed thus: Diſſecting off the integuments from the breaſt in the uſual way, they may be laid back until the tumors on each ſide of the ſternum are completely laid bare. But it may happen, that when the dilatation has proceeded freely in this direction, the ſkin (if it have not actually burſt) is ſtretched and inflamed, and has become as it were one ſubſtance with the ſides of the cyſt, and cannot therefore be diſſected off. When the integuments are ſtill looſe, upon taking them off, the pectoral muſcle is found with its fibres thinly ſcattered over the protruding ſac, and ſtrengthening it; and the ſac itſelf appears to be compoſed of condenſed cellular membrane, with ſomething like the natural coats of the artery forming its inner layer.

If it be intended to make a preparation of the diſeaſed parts, the ſternum being looſened from its attachments, the heart may be taken out alongſt with it, and afterwards diſplayed with the dilated artery puſhing through the interſtices of the ribs. It, however, ſeldom happens that we can be thus far maſters of our time in private diſſection. When the ſternum is raiſed in the common way, the tumor of the aorta is found adhering with a broad circumference to the under ſide of the ſternum: this muſt be cut through, and with the coats of the aorta we muſt cut much hard coagula of blood.

Upon examining the under ſide of the ſternum, the bony part of the ſternum will in general be found waſted by the blood. Sometimes the cartilages, alſo, are found waſted; but they ſeem better to reſiſt the blood. The blood muſt affect the bones by inſulating them, and depriving them of the membranes which nouriſh them, and alſo by mechanical action. Upon examining the aneuriſmal ſac, it will be found greatly thickened, irregular, with white callous ſcales or tubercles embued with a matter reſembling pus; and upon the inſide of the ſac lamellated clots, partly reſembling membranes, partly concreted blood. Upon turning the attention to the heart, it will, I think, be found ſmall and firm in its texture, and forced lower down in the breaſt. Upon looking down into the dilated aorta, the valves appear thickened and white with concretions.

In thus deſcribing the manner of examining theſe aneuriſms of the great arteries, the moſt common circumſtances attending them have been detailed; yet a great variety of appearances muſt preſent themſelves to us. The coats which fill up the great bag of the tumor ſhould be examined, ſo as to acquire ſome idea of their progreſſive formation; for this may perhaps explain ſome of the ſymptoms during the patient's life, as the ſudden ſubſiding of the tumor, its more ſuppreſſed pulſation, &c. Or the tumor of the artery may be found compreſſing the trachea or lungs, or encroaching upon the cava, or in ſome more immediate way affecting the reſpiration or the circulation of the blood.

Of the veins.—Dilatations in the veins near the heart never do happen but as a conſequence of the dilatation of the right ſide of the heart with blood; and in that caſe it is not a permanent increaſe of ſize in the veins, but a dilatation from the occaſional fulneſs, cauſed by the difficulty of circulation in the heart: —it is ſtrictly connected with the diſeaſes of the heart, and they cannot be conſidered ſeparately.—A remarkable diminution of ſize in the veins near the heart is more common. In Plate VI. there is given a ſlight etching of the veins of a child at this place, where they were not larger than the veins of the arm. I had no opportunity of obſerving the effect of this during the patient's life: but the ſize or fulneſs of the heart ſeemed in no way affected by it.

There are inſtances of the great veins being quite impervious; a fibrous polypus-like matter, or hard fleſhy ſubſtance, or a fatty medullary-like ſubſtance, filling up their cavities. And that they were impervious during life was confirmed in theſe inſtances, from the ſmaller veins being dilated to carry the blood; in one caſe, the ſpermatic vein in the belly; and in another inſtance, the vena azygos in the breaſt. There have been found in the leſſer veins (in thoſe of the pelvis, and parts of generation,

it would appear, more frequently) little ſtony concretions, round, and ſometimes moveable. Ruptures, too, of the great veins are ſaid to have happened; but this is a very rare diſeaſe. The peculiarities in the veins of the extremities come afterwards to be conſidered.

DISEASED APPEARANCES UPON OPENING THE PERICARDIUM.

Upon opening the breaſt, there is always more or leſs water found in the pericardium. When the quantity is conſiderable, it is commonly accompanied with general dropſy or hydrothorax: the colour of the fluid takes a tinge from the blood, in the ſame way as macerating the heart in water would colour the water, though the cavities of the heart were tied up.

The pericardium is ſuppoſed to have a greater proportion of water, becauſe it has a greater degree of action: but the additional explanation of Mr John Hunter, viz. that it may alſo fill up the interſtices betwixt the rounded ſurfaces, though ingenious as applied to the pericardium, does not mark a difference betwixt other cavities and the pericardium. Even the ſmaller collections of water in the pericardium are frequently accompanied with ſimilar collections of water in the other cavities of the breaſt, and even in the belly: but water, if contained in the pericardium, is at once obſerved; while the ſmaller quantities of water in the cavity of the breaſt ſink behind the lungs, and are not diſtinguiſhed. Extravaſations of water into the pericardium are common in all lingering diſeaſes, where the ſtrength of the ſyſtem is completely exhauſted. It probably is thrown out in the laſt feeble efforts of life. It is obſerved, that however much water there may be contained in the pericardium, ſtill, upon diſſection, this membrane is not found diſtended, but appears rather looſe about the heart. This may happen from a deficiency of blood at this time in the heart, while in the living body the heart, during its utmoſt diſtention, may have been cloſely embraced by the pericardium.

In the pericardium there are often found ſpots of extravaſation, the effect probably of recent inflammation. Sometimes the inflammation is more generally diffuſed over its ſurface; or we find adheſions formed at different points betwixt the heart and pericardium; and it happens alſo, though rarely, that the adheſions are complete in all the extent, uniting the pericardium with the whole ſurface of the heart.

Exudation of coagulable lymph is frequent within the pericardium. The lymph thus thrown out being by inflammation connected with both ſurfaces (with the heart and with the inſide of the pericardium), is found drawn curiouſly into fibres; or perhaps taking a firmer hold upon the heart, and forming no communication with the pericardium, it is found adhering to the heart with an irregular and ſpongy ſurface towards the pericardium.

The pericardium is liable to a more permanent diſeaſe. It becomes thick, ſo as to be eaſily ſeparated into layers like the coats of arteries, though in a leſſer degree. And although we ſhould not ſuppoſe ſuch membranous ſurfaces as the pericardium liable to ſuch a diſeaſe, it has been found ſtudded over with white ſchirrous tumors containing pus.

Matter, too, is found upon the ſurface of the heart; for it is ſubject to ulceration. I have ſeen it irregular and foul with diſeaſe upon the ſurface, and covered with a viſcid matter; ſo that it ſeemed wonderful that the patient could have exiſted for a moment. In ſuch a caſe as this, we may naturally expect to find the lungs adhering to the outſide of the pericardium, and the pericardium again to the heart.

When the blood is found extravaſated into the pericardium, it would appear that it is ſometimes difficult to diſtinguiſh the rupture from whence the blood came; whether it was from the root of the aorta, from the eroſion of the ventricles, or from the coronary veins or arteries. And in all ruptures it will be frequently neceſſary, after carefully examining the coats, to waſh the heart out with warm water, and to ſyringe it gently into the great veſſels, obſerving carefully from whence it eſcapes. When

blood is extravaſated into the pericardium, it does not ſupport the action of the heart by its reſiſtance to dilatation; but, on the contrary, the more that the pericardium reſiſts, the more it muſt encumber the action of the heart: and when it at laſt, the diſeaſe, proves fatal, it is by the extravaſated blood ſuppreſſing the action of the heart; for in proportion as the action of the heart is great in propelling the blood betwixt the heart and pericardium, ſo muſt the compreſſion of that blood be in reſiſting the future dilatation of the heart.

Of the appearances of the heart as altered by disease.—There are no two appearances ſo common, and ſo much connected, as a bloated, ſoft, and watery ſtate of the body, and a ſoft, flabby, and enlarged heart—where the heart ſeems in ſympathy with the languid and diſſolved ſtate of the body. Such a ſtate of the heart may be expected when the complexion has been of a pale and leaden colour, with languor of all the bodily functions, and a gradual loſs of ſtrength; the pulſe becoming weak and ſmall, accompanied with frequent faintings, and ſenſe of weight and oppreſſion at the heart. The conſequence of a diſordered ſtate of the functions of the lungs upon the heart, and the loſs of that reciprocal connection which is kept up during health, muſt often give riſe to ſymptoms which are aſcribed indiſcriminately to the heart. When the breathing is gradually ſtopped in experiments with artificial breathing upon living animals, the heart becomes languid in its actions, and ſwells up with blood, which it is unable to propel. The blood undergoes its changes in the lungs imperfectly, and in this ſtate is received into the circulation, and is ſent into intimate union with the whole body. The effect of this contaminated blood is immediately perceptible upon the heart,—not that it is leſs capable of irritating the heart to action, but that it is incapable of beſtowing the principle of action upon it through the medium of its circulation in the coronary veſſels. Then the irritability of the heart is deſtroyed, the blood is puſhed into the heart by thoſe powers which are not ſo immediately affected by the loſs of the moſt eſſential properties of the blood, and the auricles and ventricles are overpowered with blood. This is an experiment which we muſt conſider as imperfect, but it may lead us by analogy to the explanation of nearly the ſame phenomena in diſeaſe. When the powers of the ſyſtem fail, when the action that muſt take place betwixt the fluids and ſolids is in any way interrupted, then is the delicate ſenſibility of every organ to its peculiar ſtimulus and action diminiſhed. And when ſuch an effect as this is produced upon the heart (and it muſt take place in the laſt ſtages of many debilitating and tedious diſeaſes), then does this ſtate of the heart almoſt infallibly preſent itſelf upon diſſection; the heart is enlarged, ſtuffed with blood, and flaccid in its texture, the aqua pericardii is in conſiderable quantity—and often the whole body is tabid. In this caſe, where the diſtention of the heart is habitual, the aorta is found remarkably ſmall, being allowed gradually to contract its diameter to ſuit the weak contractions of the heart; but ſtill the artery is not (as we ſhould expect from this explanation) thick as if its coats had contracted, but remarkably thin and delicate. Nor muſt we ſuppoſe, that the ſtate of the artery is in contraſt with that of the heart—the heart being diſeaſed, while the artery is in a ſtate of healthy contraction; for the artery ſuffers the ſame loſs of power with the heart. The difference is, that much blood is ſent in upon the heart, which it is unable to puſh forward, and its ſides are thin and dilated, while in the arteries there is a deficiency of blood.—Were it poſſible to conceive, that the heart ſhould regain its healthy powers while the artery remained in this ſtate, the artery would be too weak for the powers of the heart. It muſt be remembered, that though the muſcular power of the artery is weakened, yet a permanent dilatation will not be produced whilſt its elaſticity remains:—for the arteries in their contraction have not to combate with the heart, but with the veins; therefore the arteries will not be permanently dilated by the contraction of the heart, unleſs when, as in their diſeaſed ſtate in aneuriſm, they are incapable of contracting again: And whilſt the contractibility of the arteries remains greater than that of the veins, they will not be ſeen dilated in the dead body.

We find uniformly, that when the heart is diſtended with blood, the right ſide of the heart is the moſt diſtended. This may be explained from the conſideration of the difference betwixt the two circulations. The circulation through the body is the moſt extenſive; and having greater power, muſt, upon the ceaſing of the heart's motion, continue for a little to pour the blood into the right auricle and ventricle, while the left ſide of the heart has neither the ſame quantity of blood in the circulation of the pulmonary veſſels, nor are theſe veſſels ſo extenſive, nor do they poſſeſs ſo great an elaſticity, as the aortic ſyſtem, and the extended veins of the body. Neither will the thick and ſtrong ſides of the left cavities of the heart allow of diſtention ſo eaſily as the right. The blood in the great veſſels of the body is forced in upon the right ſide of the heart, when, from failure of its powers, it is incapable of propelling it into the lungs, and conſequently into the left ſide of the heart.

In conſidering palpitations of the heart, we muſt remember, that the natural pulſation of the heart againſt the ribs is not the dilatation or contraction of the heart itſelf, but the effect of its contraction upon the arch of the aorta, as explained by Dr Hunter. But in violent palpitations of the heart, where it is enlarged, and weakened in its powers, and the aorta is ſmall and inſignificant, the palpitations have been ſometimes obſerved not to be ſynchronous with the pulſe at the wriſt as the natural pulſation of the heart. In ſuch caſes, it may perhaps be the auricle which is affected with irregular motions when it is violently diſtended with blood; and the ventricles likewiſe being enlarged, the apex of the heart is forced againſt the ribs.

Palpitations or pulſations of the veins in the neck, and even of thoſe in the arms, ſometimes accompany enlargement and diſeaſe of the heart. To form a juſt conception of the cauſe of this pulſation, we muſt conſider the peculiarities in the ſituation of the veſſels near the heart (ſee p.47, 48). The pericardium, inveſting the ventricle and auricle, ſuffers little dilatation by the action of the heart:—its greateſt dilatation is during the diaſtole of the ventricles; becauſe the ſpace filled by the dilated ventricles is ſomewhat greater than that of the dilated auricles; yet the difference muſt be very ſmall. The mediaſtinum involving the pericardium ſends its membranes round the great veins which reach upwards from the auricle, and ſtrengthens them. When, therefore, the veins in the thorax are dilated, and the whole heart enlarged, there muſt be a diſtention of theſe membranes likewiſe; and the diſeaſe is not confined ſtrictly to the vaſcular ſyſtem here, but even the diaphragm and involving membranes will be found relaxed, and the cavities dropſical. By the dilatation of the veins the action of their valves is affected; they become too ſmall for the diameter of the veſſel, and the blood paſſes them. But the auricular valves, or thoſe properly belonging to the ventricles, are not affected by the dilatation of the veins; their relaxation muſt depend upon the elongation of their muſcular attachments to the inſide of the ventricle. To cauſe a pulſation to be felt in the veins without the thorax, a loſs of power, both in the valves of the veins and in the valves of the heart, muſt have taken place:—becauſe if the concluſion, page 52, be right, though the valves of the veins at the lower part ſhould have loſt their power, yet while the extended circulating powers return the blood with due vigour to the heart, the contraction of the auricle will not be felt retrograde upon the column of blood in the veins: But if the heart and veins be dilated, and the tricuſpid valve have loſt its action, ſo as to allow the blood to recede again from the ventricle into the auricle during the contraction of the ventricle (the contraction of the latter being greater than the firſt), the pulſation will be obſcurely felt in the veins of the neck, beating ſynchronous with the arteries through the body.

In examining theſe diſeaſes of the heart therefore in diſſection, or in conſidering the ſymptoms during life, much is left to be decided upon by reaſoning from the ſymptoms. It may be required to decide, Whether this pulſation be communicated to the enlarged veins by contiguous arteries—or by a pulſation from the auricle—or whether it be communicated from the ventricle, through the auricle and the column of blood in the veins? or whether, again, the tremulous trilling feeling in the veins may

not be produced by the action of both auricle and ventricle? In theſe diſeaſes, the pulſe is ſo irregular and quick and feeble, that it will be difficult to ſay whether the beating of the veins is ſimultaneous with that of the arteries (and conſequently of the ventricle). In diſſection, again, we have to examine the dilated ſtate of the veins near the heart, and the ſtate of their valves; the degree of relaxation over the whole membranes of the cheſt; the ſtate of the auricle; the relaxation of the ventricles, of the columnæ carneæ, and of the valves of the heart.

Dilatations of the cavities of the heart are improperly called aneuriſms: but there have been caſes which ſeem to have truly deſerved the name, where the ventricles of the heart have at a point been dilated into a pouch filled with coagulated blood.

Of diseased appearances observable upon opening the heart.—To examine the diſeaſes in the cavities of the heart, it is evident, that it muſt be diſſected with as much care as for the demonſtration of its ſimple anatomy (See page 35.). There is one circumſtance, however, which may be remembered, that it may be required to examine coagula or polypi of the heart, which may reach from the ventricles into the great veſſels, the aorta, or the pulmonary artery. To demonſtrate theſe through their whole courſe, the cavities of the heart may either be laid open while the heart is in the body, or the great arteries ſlit up, and the coagula withdrawn from them, and kept attached to the heart. And in this caſe, the coagula being ſtrong and minutely ramifying through the lungs or aorta, form a beautiful demonſtration, when the cavities of the heart are opened, and their roots ſhown attached to the irregular inſide of the ventricle, and the intricate interlacements of the cordæ tendineæ. That theſe polypi formed from the blood are for the moſt part formed after death, there can be little doubt; but ſtill there are circumſtances to be attended to which have induced many to believe that they are formed during life. They are found in layers; which argues a ſucceſſive formation: or they are attached to the ſides of the arteries where their coats are diſeaſed; and their attachment does not appear to be accidental or owing to the ſimple coagulation of the blood. In many inſtances, however, where theſe coagula are remarkably firm, and ſuch as we ſhould ſuppoſe were formed during life, we find, upon examination, that the extremity, which is looſe, lies in a direction contrary to the courſe of the blood; a direction in which we muſt be ſenſible it could not have remained during life; for it muſt have been driven in the direction of the current of blood, while the root was held nearer the heart. There muſt be coagula formed in dilated arteries: and to diſtinguiſh betwixt thoſe which have been formed during life, and impacted in layers filling the dilated bag, and thoſe which have been formed after death, is often impoſſible. How, then, in the caſe of the coagula prolonged into the great veſſels (which alone are called polypi), can we expect to diſtinguiſh what has been formed in the laſt feeble actions of the heart, from thoſe which have been formed after death? Were they ever formed in the vigour of the ſyſtem, we ſhould have had caſes of ſome ſmaller part being torn from the trunk or ſtem of the polypus by the force of the circulation, and driven into ſome of the branches of arteries, ſo as effectually to interrupt the circulation of ſome important part.

Upon the whole, in examining coagula in the heart and great blood-veſſels, it may be obſerved, whether they have been formed at once, and are of a uniform conſiſtence; or whether they are of different layers, and apparently formed one upon the other at different times, and during life; whether, when they are attached, they have their looſe extremities reverſe to the current of circulation; or whether they have coagulated ſo ſlowly that the red globules are depoſited or fallen from the upper part of the coat.

Of the valves as subject to disease.—The muſcular coat of the aorta is not continuous with the muſcular fibres of the heart; probably becauſe their actions are alternate: but the inner coats of the

Plate IX.

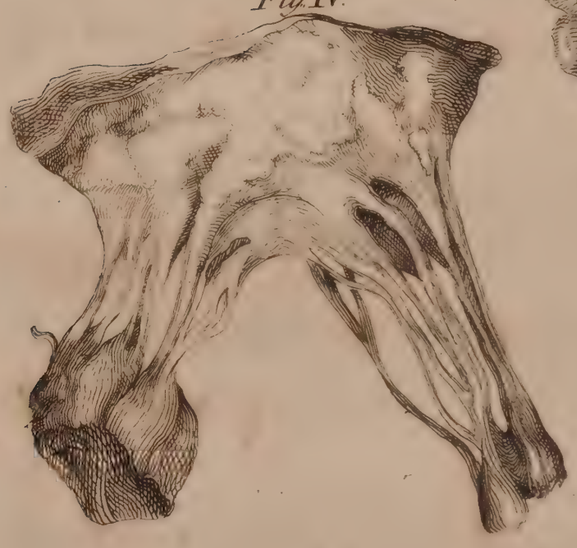
Fig. III.

Fig. II.

Fig. I.

Fig. V.

Fig. IV.



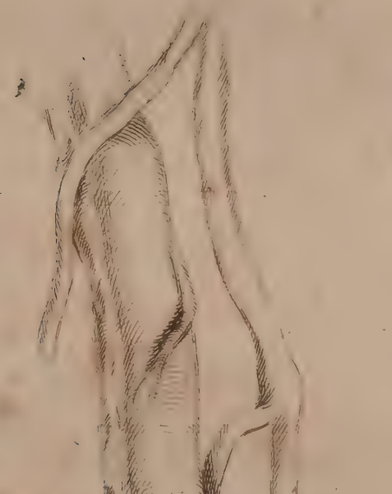


Fig. VI.

Fig. VII.

Fig. VIII.

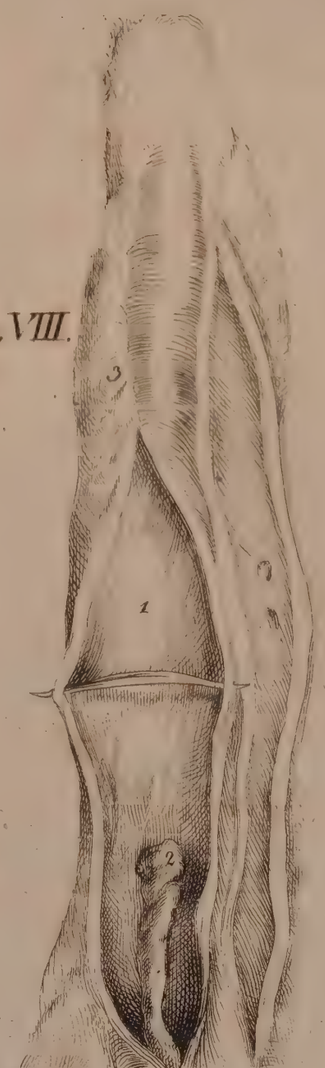
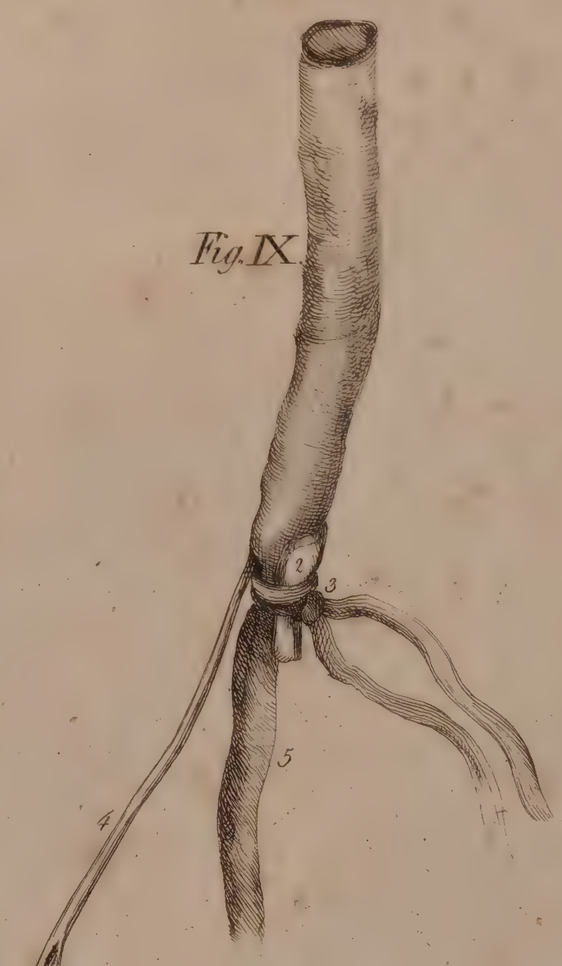


Fig. IX.



Drawn by Charles Bell

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Etchd by Chas Bell

arteries are continuous with the lining membrane of the heart and the membranous valves in the heart: the whole inner membrane of the heart, and even the tendons of the tricuſpid and mitral valves, are evidently ſubject to the ſame diſeaſe with the arteries. We ſee them partly of their natural colour, partly variegated with a more opaque whiteneſs, and increaſed in thickneſs.

THE SEMILUNAR VALVES of the aorta and pulmonary artery will be frequently found thickened and more opaque than uſual.—They are found oſſified, too, or with a depoſition of earthy matter. Upon opening the ſurface, there will be ſeen ſeveral little diſtinct ſacs. The eaſy play of theſe valves muſt be much impeded by this ſtate of diſeaſe: they muſt become ſtiff and rigid inſtead of being pliant, and floating eaſily with the tide of blood. The extreme tenuity of theſe valves, and the netted appearance of their edges, would incline us to believe that this alſo were a diſeaſed ſtate. But theſe deficiencies in the valves do not allow the blood to paſs them; they are only upon the edges, where the valves are in contact when in action. The appearance being as common in children as in adults, teaches us, that theſe holes are not worn by attrition*. It does not appear that there is an inſtance of any part of an animal body being liable to ſuch a waſte: it is endowed with powers to counteract it. Theſe valves have been found ruptured too; and this we ſhould naturally attribute to the force of the retrograde blood, and thence argue a great force in the contraction of the arteries. It is not impoſſible, however, that they might, when diſeaſed, have been ruptured by the violence of the heart's contraction occaſioning a great degree of dilatation in the root of the aorta, which they (being at all times more unelaſtic) might be unable to bear.

The MITRAL and TRICUSPID VALVES are ſubject to the ſame diſeaſed thickening, and to have concretions formed in them. In Plate IX. fig. 4. there is given a view of the mitral valve of the right ſide of the heart in this ſtate of diſeaſe. Their ſmall tendons, too, if narrowly obſerved, will be found partaking in the diſeaſe, not uniformly of the ſame colour, but partly opaque, partly more tranſparent.

OF THE SUBSTANCE OF THE HEART.—In the ſubſtance of the heart, inflammation may be obſerved, and thickening of its ſubſtance without inflammation. Inflammation in the heart itſelf cauſes the moſt irregular actions and violent palpitations. Thickening of the ſubſtance of the heart without inflammation muſt be underſtood with ſome limitation. We are not warranted to believe that the muſcular fibres are ever increaſed in ſize: much exerciſe gives to muſcles an increaſed vigour, and a capacity for new trains of actions; and the muſcle is in the dead animal actually redder, having more of the appearance of ſtrength: but ſtill there is no increaſe of ſize in the fibres themſelves.

A muſcle, when diſeaſed, is not, like a bone, to be conſidered as increaſed in ſize, though its interſticious cellular membrane may be ſwelled with tranſuded lymph. A diſeaſed thickening of the heart's ſubſtance ſeems merely the effect of inflammation, the inflammatory ſtate having ſubſided.

DISEASED APPEARANCES IN THE THORAX, INDEPENDENT OF THE HEART AND GREAT VESSELS.

OF ADHESIONS OF THE LUNGS.—Adheſions of the lungs to the pleura, where it lines the ribs, or where it covers the pericardium, are ſo frequent that they need ſcarcely be conſidered as a diſeaſe, at

* Continued preſſure ſeems to have a greater effect in cauſing abſorption; as in tumors preſſing upon the bones, in the growth of the permanent teeth encroaching upon the temporal teeth, or in the beating of arteries and aneuriſmal tumors upon the bones. But all theſe are imperfect analogies. The part which poſſeſſes the greateſt vigour is not abſorbed, but remains unaffected, whilſt the other is waſted, as in the teeth; and ſoft parts reſiſt while the bone is abſorbed.

leaſt they are of no account in inveſtigating the cauſe of death; for it would appear that the ſlighteſt inflammatious during any period of the patient's life, even from colds which paſs unobſerved, produce adheſions which are never afterwards removed.

To account for the more frequent occurrence of inflammation and adheſions in the membranes of the breaſt, there have been ſeveral hypotheſes ſuggeſted; and particularly it has been ſaid, that the veſſels which ſupply theſe interior membranes are branches of arteries common to the pleura and integuments of the breaſt; and that the outer branches being more liable to occaſional derangement in their action, an accumulation is brought upon the inner branches. But the diſtribution of the mammary and intercoſtal arteries, when compared with the epigaſtric in the abdomen, or with the diſtribution of veſſels to any other internal membrane, does not ſupport ſuch a conjecture; for they alſo have external branches: and if there be found a greater frequency of inflammation in the thorax, it may rather be imputed to the peculiarity of the lungs as inhaling the air, and being conſequently more liable to ſuffer from the viciſſitudes of the weather.

Consequences of inflammation.—Inflammation exiſting immediately before death often throws out a layer of coagulable lymph upon the pleura; and it can be felt upon the inner ſurface of the ribs, and torn from them with the fingers a tremulous gelatinous layer; or upon the ſurface of the lungs a jelly is thrown out, which can be wiped away with a cloth. Theſe exudations approach in their more advanced ſtages to the appearance of membranes, and can with difficulty be diſtinguiſhed from the original membranes. Any vacancy found in the thorax from diſeaſe, as from the deſtruction of the lungs of one ſide, and the formation of pus, is generally accompanied with theſe layers of coagulable lymph upon the inner ſurface of the ribs, and with inflammation and thickening of the pleura; or we find a ſerous fluid in the bottom of the cheſt, with flakes of the coagulable lymph, like membranes, floating in it.

When the lungs become diſeaſed, and abſceſſes form in their ſubſtance, the inflammation extending round them, and communicating through the pleura pulmonalis or external coat of the lungs, forms adheſions betwixt the lungs and ribs or pleura coſtalis. By this means the matter of the abſceſs, when it has made its way out of the lungs, is ſtill held confined in a ſac, and prevented from ſpreading freely into the whole cavity of that ſide of the cheſt. From this pervading of the inflammation previous to the burſting of an abſceſs in the lungs, we have frequently this appearance upon opening the breaſt: the lungs are compreſſed, hard, and apparently incapable of their function; coagulable lymph is extended upon the ſurface of the pleura; partitions are formed extending from the inner ſurface of the ribs to the colapſed and hardened lungs; ſinuſes of matter are ſeen running among theſe irregular adheſions, and the lungs themſelves, if far advanced in the diſeaſe, are full of pus in many places, which eſcapes upon their outer membrane being torn open.

Of abscess not communicating with the lungs.—Collections of matter may be formed in the cavities of the cheſt, independent of the lungs, from the inflammation of the pleura advancing to ſuppuration; and collections of matter, or of ſerum, have been found betwixt the pleura coſtalis and the ribs, which have puſhed the pleura in upon the lungs, and compreſſed them. It would ſeem to be a general opinion, that matter formed in the membranes, independently of the lungs, has a greater tendency to open outwardly by the intercoſtal ſpaces, than that matter which, though lodged in the cavity of the cheſt, was originally derived from the lungs.

Of the lungs in a state of disease.—In cutting into the ſubſtance of the lungs of conſumptive people, the moſt frequent appearance is groups of little white or variegated tubercles. Theſe, in a more advanced ſtage of the diſeaſe, make the ſurface of the lungs hard and irregular; and when the lungs are cut into, the tubercles are found to be larger, and to have run together into maſſes, and commonly

little abſceſſes have formed in them;—or, the tubercles being diſtinct, they are found to contain a white thick pus. In their ſtill further advancement, they have totally degenerated into matter, which is contained in diſtinct ſacs; and the whole lungs gradually approach to that ſtate which has already been ſlightly deſcribed, viz. the lungs contracted, and with hard cartilaginous or ſcirrhous tumors,—ſmall purulent abſceſſes, or large vomicæ, and ſtuffed up with innumerable irregular tumors—ſome dormant, others inflamed and ſuppurated.

Of the state of the large vessels in abscess, &c.—In large abſceſſes of the lungs, where they are in a manner degenerated into ſacs full of matter; or in that ſtill more extraordinary ſtate of the viſcera, where one of the lungs is waſted to the mere bud of its root, and the whole ſide of the cheſt is left empty, with a mixture of pus and water in the bottom of it—the pulmonic veſſels have been found with open mouths, as if opening into the cheſt. In general, in this ſtate of the lungs, the veſſels will be found contracted at their extremities for about an inch and a half, and cartilaginous to the feeling; or inſtead of this, probably in a leſs advanced ſtate, there have been found coagula formed in their extremities, plugging them up like the artery of a ſtump after amputation. From examining the ſtate of large arteries, either when ſtopped by ligature or by an effort of nature, as in the formation of abſceſſes, it would appear that the formation of coagula depends much, if not entirely, upon the coats of the artery. In ulcerated ſurfaces, and in the formation of matter (as in the preſent inſtance, in the lungs), the coats of the artery, partaking of the inflammation in which it is involved, and which extends from the ſurface ulcerated to the ſurrounding parts, form a clot by the exudation from the inner ſurface of the veſſel, and partly from the maſs of blood in its cavity.—And the clot thus formed has a firm hold upon the ſides of the veſſel, and an intimate connection with it. It is the connection with the ſurrounding parts which ſupports the artery of an aneuriſm, or of a ſtump, after being tied. This connection, by ſupplying its little veſſel, gives ſupport to its inflammation, and aſſiſts in the production of a healthy clot. But if the artery be left expoſed in the middle of an abſceſs, or left diſſected from the ſurrounding parts, then that part which is expoſed will have no proper clot or contraction of its coats; but the coagulum which ſtops the bleeding will be found at that point of the artery which has a connection with the ſurrounding fleſh. If, again, the coats of a veſſel tied in an aneuriſm (as that marked in fig. IX. Plate X.) be diſeaſed, partaking of that oſſified ſtate which has already been fully deſcribed as accompanying the dilatation of arteries, they will probably (as in the caſe from which this drawing was taken) be rendered by irritation unſuſceptible of active inflammation: and upon the cutting of the artery by the ligature, there will be found no proper clot formed in the artery coaleſcing with its coats, ſo as in time to form a complete union; but, on the contrary, there is nothing to reſtrain the blood from flowing but the mechanical tying of the ligature, and immediately upon the cutting of the artery by the ligature, the blood eſcapes. It is certain, that in thoſe diſſections deſcribed by Haller and others, in which the mouths of the trachea and great veſſels were ſeen projecting from a remaining bud of the lungs, the clots muſt have been formed a little within the mouths, and the veſſels cloſed up in the common manner.

Of concretions of the lungs.—In Plate IX. fig. 1. is repreſented an earthy concretion adhering to the aorta: It was found in the lungs of a phthyſical ſubject, and is rather a frequent occurrence. The lungs were indurated, and adhering in many places;—they ſeemed to have ſuffered much inflammation, and adhered firmly to the pericardium and great veſſels. There were many ſuch maſſes of calcareous concretions throughout the lungs; and this part was kept attached to the diſeaſed aorta, as at that time I thought it might have had ſome connection with the diſeaſed ſtate of its coats. Theſe calculi in the lungs are found in irregular cyſts; crumble eaſily in the fingers; but take a ſtony firmneſs when dried. They grate upon the knife in diſſecting the lungs; and, it would appear, are ſometimes

found in the extremities of the branches of the trachea. I have ſeen them ſo large as to preſs upon the aorta and upon the trachea, turning them from their ſeat.

The lungs are not unfrequently found turgid with air, and incompreſſible, not ſubſiding upon the opening of the thorax, nor even when pricked with the knife. In ſuch caſes they are ſometimes red with blood, or are ſpotted with black extravaſated blood upon their ſurface;—or when cut into, thick pus is gradually expreſſed from the ſmall branches of the trachea (as was the caſe of the ſubject from which Plate VI. was drawn), or much froth is found in the branches of the aſpera arteria; and when cut into, they are found ſtuffed with viſcid ſlimy matter.

The colour of the lungs, too, muſt be obſerved, whether affected by inflammation, or whether ſeeming to be more permanently changed:—they may be found blanched and pale, or of a cineritious colour, from the loſs of blood; or they may be found variegated in their colour, betwixt a purple and a lake, ſtudded with white opacities, produced by tubercles. It muſt be always remembered, that in diſſection, allowance ſhould be made for the gravitation of the blood towards the back part, the body lying ſupine after death.

In examining the inflammations of the membranes of the cheſt, the ſtate of the intercoſtal muſcles ſhould not be overlooked.

Of examining the trachea.—It will frequently be neceſſary to examine the inſide of the trachea through its whole length, as it is often the ſeat of diſeaſe. It may be neceſſary to examine it to know the cauſe of ſuffocation:—it may be compreſſed by tumors;—it may be eroded by obſtinate ulcers;—it may be inflamed, and polypous membranes may have been thrown out from its inner ſurface, which being ſometimes expectorated, reſemble veins; being moulded to the branches of the trachea and pervious. When the trachea is to be examined, in order to trace a diſeaſe which is connected with the lungs, the inciſion may be continued from the thorax upwards upon the fore part of the neck, and the trachea laid bare:—and being cut below the thyroid cartilage (or even the whole larynx being diſſected out), it may be diſſected from the œſophagus, and carried down to its bifurcation in the lungs; it being kept at the ſame time attached to the lungs by its branches. It can then be opened upon its back part, and ſlit down its whole length, when any polypous membranes thrown out by inflammation may be diſtinctly ſhown, and traced in their progreſs in the lungs. When the trachea is replaced, and the inciſion upon the neck ſewed up, the body is left in no way unſeemly about the face; which in private diſſection muſt always be avoided.

The Diſſection of the Diſeaſes of the Throat will be afterwards conſidered in treating of the Neck and Head.

Diseased appearances in the mediastinum.—The posterior mediastinum which ſurrounds the great veſſels that run down the ſpine behind the great viſcera of the thorax, is not unfrequently the ſeat of diſeaſe. The lymphatic glands which lie at the root of the lungs are ſometimes diſeaſed; they are enlarged, or gritty matter is found in them which grates upon the knife; or they are found in a ſtate of ſuppuration. Their diſeaſe will perhaps account for ſome of the ſymptoms which may have occurred during life; for they may be found to have compreſſed the trachea, the œſophagus, or the great veſſels, as the aorta, thoracic duct, or vena azygos.

When the conglobate glands are affected in one part, it will be found more or leſs a general diſeaſe in the thorax, in the courſe of the aorta and iliac veſſels, in the meſentery, &c.

The anterior mediastinum differs in no reſpect as to its diſeaſes from other depoſits of cellular membrane where there is much fat and many glands and blood-veſſels: it is ſubject to inflammation

and the formation of abſceſs. A great accumulation of fat here has been conſidered as a ſerious diſeaſe, and even upon diſſection aſſigned as the cauſe of death.

The premature accumulation of fat upon the viſcera may be conſidered as a diſeaſe; though in old people it is natural. This load of fat upon the viſcera is the laſt ſtage which the adipoſe membrane undergoes from the fœtus to old age. But the qualities of the fat, and its place of depoſite, are more changed than its quantity. It is not drawn from the extremities to the heart and viſcera, but from the ſurface to the interior parts. In the fœtus, when the hard and unelaſtic integuments are diſſected off, the muſcles are left bare, and the further diſſection is eaſy, the fat being firm and inſulated, and external chiefly. Here the delicacy and neatneſs and beautiful form of the muſcles and tendons will be more the object of admiration then even in the adult. The integuments of the fœtus in delivery is its great ſtrength. In a youth whoſe limbs have become ſhapely, the fat is more equally diffuſed over the interſtitious cellular membrane, the diſſection becomes more difficult, and in old age it has become ſtill more tedious and impracticable; for every part oozes out oil, and the diſſection can never be freed from fat. The fat, which to the infant gave unformed rotundity, and to the middle age ſymmetry and ſhape, has left the integuments, and is more equally diſtributed; it is now more accumulated about the internal parts, and more intimately blended with them. The fat does not remain in the cells any length of time, but, like the reſt of the body, it muſt ſuffer a perpetual ſeries of changes; be reſumed into the circulating ſyſtem, as ſubſervient to other uſes, whilſt the cells are at the ſame time filling with a new depoſition. It is natural to ſuppoſe, that the ſtate of the fat changes with that of the ſolids, and has a ſtrict connection with the economy of the body. Yet how inſufficient is that explanation of the accumulation of fat about the viſcera which aſſigns to it the uſe of rendering pliant and eaſy of motion theſe important parts which are now ſtiff and inactive with old age: it is to ſuppoſe the moſt important viſcera of the body to be greaſed like the wheels of an engine.

The membranes of the body, though loaded with fat, are not oily upon their natural ſurface: the attrition of ſurfaces in an animal body is prevented by their own ſecretion; and the animal oil, though it eſcapes upon the adipoſe membrane being ſlit up, yet in the living body cannot tranſude, to oil the moving parts. It is not long ſince the opinion was entertained, that the fat was laid in the track of the coronary veſſels of the heart, to preſerve them from thoſe diſeaſes to which the arteries were liable in other parts of the body; the evil conſequences of which would be manifold in the heart.

EXPLANATION OF THE PLATES.

IN all the deſcriptions of the Plates the enumeration of the parts will be irregular and unconnected, for the letters follow the references of the text; which might have been the only explanation required.

PLATE V. Is a view of the muſcles and blood-veſſels lying upon the left ſide of the breaſt and lower part of the neck. MUSCLES—a b c f k, The great pectoral muſcle; which, at l, is about to be inſerted into the arm-bone—d, The deltoid muſcle—e n, The clavicle—g g g, The ſerratus major anticus—h, The abdominal muſcles—i i i, The origins of the obliquus externus abdominis—m, The latiſſimus dorſi—o, The acromion proceſs of the ſcapula projecting—q r, The ſterno-clydo maſtoid muſcle—s, The trapezius muſcle, and levator ſcapulæ—t, The omo-hyoideus.

ARTERIES.—1, A branch of the third thoracic artery—2, Subclavian vein—3, Axillary artery—4 5 6, Branches of the internal mammary artery coming up through the interſtices of the ribs—7, The external mammary artery—8, The axillary glands enveloped in fat—9, The external jugular vein—10, Arteria tranſverſalis coli—11, Lymphatic glands lying upon the ſide of the neck—12, The diaphragmatic nerve—13, Nervus acceſſorius—14, The carotid artery—15, The internal jugular vein—16, The eighth pair of nerves—17, Deſcendens noni.

PLATE VI. The ſternum raiſed, and the viſcera of the thorax, ſeen in their natural ſituation.—a a, The under ſurface of the ſternum, from which the anterior mediaſtinum is torn in lifting it—b b, The mediaſtinum ſeparating into two layers as it is torn from the ſternum, and thus forming a kind of triangular cavity d.—c, The heart covered by the pericardium—e f g, The anterior middle and poſterior lobes of the lungs of the right ſide—h i, The anterior and poſterior lobes of the left ſide—k, The diaphragm pulled up from the liver (which is in outline) by the raiſing of the ſternum—l, The phrenic nerve attached to the pericardium.

FIG. 2. Shows the ſhape of the valve of the jugular vein, and the dilatation of the vein above it.

FIG. 3.—The ſuperior cava and ſubclavian vein, much contracted, in a child.

PLATE VII. In the firſt figure of this plate the heart and lungs are ſeen in the ſame poſture as in Plate VI. only the pericardium and diaphragm are taken away. The heart is ſeen inclined to the left ſide—The right ventricle A, is forward—The left C, is behind—The coronary artery and vein (d) mark their diviſion—a, Is the pulmonic artery—b, The aorta—c, The ſuperior cava—i, Marks the very ſhort trunk of the vena cava, common to the vena cava hepatica and vena cava abdominalis h.—e, Is the right auricle.

The lungs need no references.—The ſubclavian vein of the left ſide is marked E, as it paſſes before the branches of the aorta—x, Is the right ſubclavian artery—y, The carotid of the left ſide—z, The ſubclavian artery of the left ſide. The aorta, turning round the pulmonary artery and trachea, gains the ſpine, and runs down upon its fore part. It is ſeen again as it is about to enter the abdomen; and here it gives off the phrenic arteries. The cœliac artery is marked l—The ſuperior meſenteric artery m—The inferior meſenteric artery n—o Is the emulgent artery of the right ſide—p, the emulgent artery of the left ſide—q r, The emulgent veins—s t v, The thoracic duct, which is ſeen here running up by the ſide of the aorta, and appears again at D, where it terminates in the angle betwixt the left jugular and ſubclavian veins.

Figure 2d, 3d, 4th, 5th, are explained in page 35.

PLATE VIII.—A, The internal jugular vein—B, Carotid artery—C, The digaſtric muſcle—D, The ſtyloid muſcles—E, The ſubclavian artery—F G, The ſubclavian vein—H, The right branch of the trachea—I, The pulmonic veins tending to the left auricle—K, A cluſter of lymphatic glands—L, The œſophagus—M, The aorta—N, The azygos vein—O O O, The ribs cut down to have acceſs to the ſympathetic nerve—P, The diaphragm.

NERVES.—1, Par vagum—2, Sympathetic nerve—3, Ninth pair—4, Deſcending branch of the ninth pair—5, A branch of the firſt and ſecond cervical nerves joining the deſcendens noni, and with it

distributed to the thyroid gland and muscles on the fore part of the trachea—6, Accessorius—7, Recurrent nerve turning round the subclavian artery—8, The recurrent, seen running up upon the œsophagus—9, Branches of the eighth pair going to the pericardium and heart. Being followed, they are found encircling the great vessels proceeding from the heart, and joining with branches from the intercostal nerve—10, Thoracic ganglion of the intercostal nerve; found by the meeting of the branches of the nerve which twine round the arteries of this part after parting from the lower ganglion of the neck 15—11, 12, 13, Origin of the DIAPHRAGMATIC nerve from the third and fourth cervical nerves—14, The phrenic or diaphragmatic nerve twisting round under the subclavian vein—16, Its distribution in the diaphragm—17, Numerous branches of the eighth pair going to the lungs—18, The eighth pair gathering again into one trunk after splitting irregularly as it descends upon the œsophagus—19, Progress of the sympathetic nerve down the side of the spine—20, 20, Filaments forming the anterior branch of the sympathetic—21, Thoracic ganglions of the intercostal nerve—22, The dorsal nerves, or proper nervi costales.

PLATE IX.—FIG. I.—The arch of the aorta enlarged; with a portion of the lungs, containing a calcareous concretion attached to it—1 1, Concretions in the artery seen upon its outer surface by the drying of the coats—2, The concretion in the lungs.

FIG. II.—A part of the aorta, where it proceeds from the heart slit up—1, Points to the opacities in the diseased aorta, which, when further advanced, contain gritty matter—2, The semilunar valves thickened, and partaking of the diseased state of the coats of the artery—3, Concretions formed below the valves.

FIG. III.—The coats of the aorta at its bifurcation into the iliac arteries, held thus extended, though dried, by an extensive scale of ossification.

FIG. IV.—The mitral valve loaded with concretions.

FIG. V.—The fœmoral artery in a diseased state, with its coats dissected—1 2, The outer coats of the artery dissected into two layers—On the other side 3 they are separated into three layers. The muscular coat is exposed with its fibres running in circles round the artery: It is inaccurately marked 3 in the text—4, Is the inner coat of the artery, with scales of ossification connected to it.

FIG. VI.—The fœmoral artery dissected from the stump after amputation—1, The great ligature tying the trunk of the artery, and including a branch (2) of the anterior crural nerve—3, Another branch of the nerve included in the ligature tying a smaller branch of the artery—4, The crural nerve— 5, The clot reaching up into the pervious part of the artery, and adhering to its side—At 6 the clot coalesces more intimately with the coats of the artery—7, Part of the cellular membrane which surrounded the artery condensed by inflammation, and adhering to it.

FIG. VII. The splenic artery ossified—1 1, That part of the artery which, being membranous still, has shrunk in the drying—2, Scales of concretions almost totally surrounding the artery.

FIG. VIII.—The artery of the stump left more rudely dissected than in Fig. VI.—1, The cavity of the artery—2, The clot—3, The inflamed cellular substance surrounding the artery. The accompanying vein is seen opened likewise, and its coats much thickened.

FIG. IX.—The fœmoral artery, with a ligature upon it for the cure of the popliteal aneurism.

2, A piece of wood included in the ligature 3,—4, A probe passed into the artery where its coats were cut by the ligature; evidently from the diseased state of the artery. See p. 63.

DIRECTIONS FOR PLACING THE PLATES.

PLATE V. facing page 28.
PLATES VI. and VII. facing each other between pages 34 and 35.
PLATE VIII. facing page 44.
PLATE IX. facing page 60.

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A

SYSTEM

OF

DISSECTIONS.

PART III.

CONTAINING

THREE DISSECTIONS OF THE PERITONEUM,
INFERENCES DRAWN FROM THESE VIEWS OF THE PARTS,
THE SECTION OF THE PELVIS,
POINTS OF SURGERY ILLUSTRATED BY THE SECTION OF THE PELVIS,

THE CONTENTS OF THE PELVIS AS SEEN FROM BEHIND, AND PLAN OF THE ARTERIES,
OF THE DESCENT OF THE TESTICLE,
OF HERNIA, HYDROCELE, &c. AS ILLUSTRATED BY THE ANATOMY OF THE TESTICLE,

OF THE INVESTIGATION OF DISEASE IN THE PELVIS,
AND OF THE MORBID STATE OF THE PARTS.

WITH PLATES.

BY CHARLES BELL.

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ADVERTISEMENT.

It was intended that PART IV. ſhould have been publiſhed along with this THIRD PART; but it has been found impoſſible to have the Engravings finiſhed.

CONTENTS OF PART IV.

1*ſt*, The Firſt Diſſection of the Thigh; including the Diſſection of the Faſcia of the Thigh, of the Inguinal Glands and Superficial Veſſels, of the Lymphatics, and of the Cutaneous Nerves.

2*dly*, Of the Uſe of the Faſcia, and of the Involving Membranes of the Muſcles in general; of the Effects produced by the Faſcia in Diſeaſe; and of the Peculiarities in the Diſtribution of the Veſſels of the Extremities.

3*dly*, The Second Diſſection of the Thigh, *viz.* Of the Parts about the Groin and Upper Part of the Thigh.

4*thly*, Of the Derangement of the Natural Anatomy, in Femoral Hernia, in Encyſted Aneuriſm in the Groin and Thigh, and in Wounds of the Arteries.

5*thly*, The Diſſection of the Femoral Artery from the Groin to its Paſſage through the Triceps Muſcle.

6*thly*, The Diſſection of the Back Part of the Thigh and Ham, and of the Popliteal Aneuriſm.

The 7*th*, 8*th*, and 9*th*, Sections, with their accompanying Plates, detail the Anatomy of the Leg and Foot.

N. B. This Number will contain Seven Plates.

DIRECTIONS TO THE BINDER.

PLATE X. facing page 70.

PLATE XI. - - - 78.

PLATE XII. - - - 80.

A

SYSTEM

OF

DISSECTIONS.

ANATOMY AND DISEASES

OF THE

PELVIS.

DISSECTION OF THE PERINEUM,

Or of thoſe Parts which are chiefly implicated in the Operation of Lithotomy, and in the Diſeaſes of the Urinary Paſſages and Rectum.

PREVIOUS to the diſſection of the perineal muſcles, the arteries of the pelvis and of the lower extremities ought to be injected, that the important branches of the pudic artery, and their connection with thoſe muſcles, may be underſtood. The cavernous bodies of the penis ſhould alſo be injected, and the ſubject placed upon the table as the patient is held for the operation of lithotomy.

FIRST STAGE OF THE DISSECTION.

GENERAL VIEW OF THE PARTS TO BE LAID OPEN IN THE FIRST STAGE OF THE DISSECTION.—In this diſſection, as the muſcles and delicate arteries to be demonſtrated lie deep amongſt much looſe elaſtic cellular ſubſtance, it is of ſome conſequence to mark the depth and level of the parts. Becauſe, although at firſt the ſtudent is circumſpect, diſſecting with caution, perhaps with timidity; yet gaining courage as he proceeds, and finding that he is only ſeparating the cellular membrane, he plunges with more determined ſtrokes of his knife, till at laſt he, with much diſappointment, finds the external ſphincter of the anus, or the tranſverſalis muſcle, cut away, and the demonſtration deſtroyed: like thoſe ſurgeons who, being ſtrongly impreſſed with the idea that deliberation is the characteriſtic mark of their ability, commence their operation with an affected gravity of countenance and tedious cruelty; while in the important ſtage all

is indiſcreet hurry and confuſion. In both caſes the celerity and ſucceſs depend upon the knowledge of the points in which caution is required.

The rectum having been ordered to be thoroughly cleaned, a little baked hair may be introduced into the extremity of the gut, which will keep the anus gently protruding during the diſſection; or a cork with a loop attached to it being introduced, and the mouth of the gut tied upon it, the diſſection will be much facilitated, and the demonſtration aſſiſted in conſequence of the complete management we have of the gut; for we ſhall thus be able to turn it in every direction ſo as to ſhow its connections.

The place of the ERECTOR PENIS (A A) being evident, ſince it reſts upon the ramus pubis and crus penis, it cannot be deſtroyed, and ſhould be our firſt object in the diſſection, as ſerving, in ſome meaſure, for a guide in the diſſection of all the other muſcles. The next point in the diſſection is the ACCELERATOR URINÆ (B), whoſe general courſe and appearance is ſufficiently evident from the plate: its place we cannot fail to find though the delicate fibres may be deſtroyed.

In diſſecting the EXTERNAL SPHINCTER (C) we have to recollect, that it conſiſts of looſe fibres encircling the mouth of the gut, and lies immediately under the ſkin. This muſcle is, however, frequently miſſed in diſſection, and it is indeed difficult to ſhow it neatly.

A ſure guide in the diſſection of all the muſcles, but chiefly of the TRANSVERSALIS PERINEI, is the tuberoſity of the iſchium; for the tranſverſalis perinei, taking its origin from the tough tendinous-like membrane of the os iſchium, runs directly acroſs to the general point of union, lying about two inches deep in the elaſtic fat, which fills the ſpace betwixt the anus and os pubis. By carrying the knife in the courſe of this muſcle, it will not be unwarily cut acroſs; its fibres being, in this manner, much more eaſily diſtinguiſhed and extricated from the ſurrounding cellular ſubſtance.

MUSCLES.

EXPLANATION OF PLATE X. FIG. 1.

A A, ERECTOR PENIS.—A neat and delicate muſcle ariſing from the os iſchium, ſtretches its muſcular fibres over the lower part of the crus penis, and ſpreading its expanded tendon, gradually coalleſces with the ſheath of the crus penis.

B, ACCELERATOR URINÆ. From the middle tendinous line, as from a common origin, the fibres, diverging, run obliquely upwards on either ſide, embracing the bulb and lower part of the corpus cavernoſum urethræ with a coat of muſcular fibres; which, collecting into diſtinct tendinous ſlips, are inſerted into the crura penis.

C, SPHINCTER ANI. The fibres of this muſcle, running in circles round the mouth of the gut, it can ſcarcely be ſaid to have an origin or inſertion. It takes hold of the os coccygis behind, and is attached to the accelerator urinæ before: more intimately and immediately ſurrounding the gut are the ſtronger fibres of the INTERNAL SPHINCTER.

D D, TRANSVERSALIS PERINEI ariſes from the tuberoſity of the iſchium, is inſerted into the central point of union, where the ſphincter ani touches the accelerator urinæ.

Sometimes more deeply ſeated, and above the laſt, runs a ſlip of fibres, *viz.* the TRANSVERSALIS PERINEI ALTER.

OF THE BLOOD VESSELS IN THIS STAGE OF THE DISSECTION.

All the ARTERIES ſeen in this ſtage of the diſſection are branches of the pudic artery. The pudic is ſometimes named the EXTERNAL HÆMORRHOIDAL ARTERY; but

1. Is properly the EXTERNAL HÆMORRHOIDAL ARTERY; which, branching upon the extremity of the rectum, and enveloped in the muſcular fibres, ſurrounds the anus.

2. That artery, prolonged by the ſide of the bulb of the urethra, and giving off twigs over the erector penis and crus penis, is the ſuperficial branch of the pudic artery, or the ARTERIA PERINEI.
3. The TRANSVERSALIS PERINEI is a branch from the laſt artery, diſtributed in the cellular membrane, and to the ſphincter ani.

The place of this artery is often ſupplied by ſeveral irregular branches.

The VEINS which are ſeen in this diſſection, are the pudic or inferior hæmorrhoidal veins, and accompany the arteries.

The NERVES which appear in the courſe of this diſſection, are the pudic nerves coming from the ſecond and third ſacral nerves (ſee Camper). They run ſometimes over the tranſverſalis perinei muſcle; more frequently below it; ſometimes they come out in one branch, ſometimes in ſeveral twigs. But the veins and nerves are of leſs conſequence than the muſcles and arteries.

SECOND STAGE OF THE DISSECTION.

EXPLANATION OF FIG 2.

To bring the parts to correſpond with the drawing of figure 2. we muſt diſregard the muſcles entirely, purſue the delicate branches of the arteries in a retrograde courſe (diſſecting with the ſciſſars chiefly), till we have cleared the muſcles and cellular membrane entirely away, and have a more connected view of the arteries, with their diſtribution to thoſe more important parts which now come into view.

LEVATOR ANI. In the courſe of this diſſection, we have to obſerve the intricate connections of the levator ani muſcle: It will be ſeen coming down from the neck of the bladder and triangular ligament of the urethra, and from the fibres of the ſphincter veſicæ; and in ſtronger faciculi from the ſides of the pelvis, converging to the anus, and mixing its fibres with thoſe of the internal ſphincter.

A A, TUBEROSITY OF THE OS ISCHIUM.

B B, RAMUS PUBIS.

C, CRURA PENIS.

D, CORPUS SPONGEOSUM URETHRÆ.

E, BULB OF THE URETHRA.

F, PROSTATE GLAND ſeen much retired.

G, MEMBRANOUS PART OF THE URETHRA. In diſſecting which, we have to obſerve what has been called the triangular ligament of the urethra; it will appear as of a middle nature, betwixt muſcle and tendon, ſurrounding the urethra, and connecting it and the proſtate gland with the arch of the os pubis. It gives ſtrength to the membranous part of the urethra; and being perforated by numerous veins coming from the penis, it has been been deſcribed as cavernous.

H, The BLADDER, obſcurely ſeen.

I I, The CELLULAR MEMBRANE interpoſed betwixt the bladder and gut.

K, The ANUS.

L, OS COCCYGIS.

ARTERIES.

1. The ARTERIA PUDICA COMMUNIS.
2. The PUDIC ARTERY, dividing into the PERINEAL, and the deep ſeated branch or ARTERIA PENIS.
3. The ARTERIA PENIS, the diviſion of which into the artery of the bulb is ſeen, and its contortions marked by dotted lines upon the bulb; while the main branch proceeds upon the ſeptum penis, and gives off the arteria dorſalis penis.

4. The EXTERNAL HÆMORRHOIDAL ARTERY.
5. The TRANSVERSALIS PERINEI ARTERY laid back.
6. The ARTERIA VESICALIS IMA going to the neck of the bladder and proſtate gland.

EXPLANATION OF FIG. 3.

In this figure there is a further diſſection of thoſe parts illuſtrating the preceding figures. In the ſubject from which this was drawn, the pelvis and thighs were ſevered from the trunk by the lumbar vertebræ. Ligatures were put upon the femoral arteries to confine the force of the injection to the pelvis. The bladder and rectum were filled with tepid water, and the injection of the veins and arteries made. The muſcles of the thighs originating from the pelvis being cleared away, and alſo the numerous branches of the obturator artery, with the profunda femoris and circumflex arteries, the thigh bones of both ſides were cut through. And further, to give full room for the diſſection of the arteries of the pelvis, and to bring them into a new view, the os ſacrum and coccygis were taken entirely away;—the perineum and parts of generation, with their arteries, were then carefully diſſected.

The diſſection was then placed ſo as to illuſtrate the preceding figures.

A B C D E F G H K L, have the ſame references as in figure 2.—But it may be obſerved, that the mouth of the gut K, being pulled downwards and ſeparated from the bladder H H, is conſequently drawn from its natural ſeat; the proſtate gland F and urethra G are more diſtinctly ſeen, while the viſiculæ ſeminales L L, which in the other figures lay hid betwixt the bladder and gut, are brought into view.

M M M, The hæmorrhoidal veins, and branches of the lower meſenteric veins.

N, Congeries of veins ſurrounding the neck of the bladder, chiefly derived from the vena ipſius penis.

In this figure a connected view of the perineal arteries is allowed.

1. A trunk, common in this ſubject to the poſterior iliac artery or gluteal, and to the iſchiatic artery.
2. The POSTERIOR ILIAC ARTERY.
3. The ISCHIATIC ARTERY.
4. The VESICALIS IMA of HALLER. Beſides ſurculi from this artery, the neck of the bladder and proſtate gland has twigs from the middle hæmorrhoidal artery, an artery of the rectum.
5. The PUDIC ARTERY (ſometimes called the inferior hæmorrhoidal) at that place where it appears without the pelvis.
6. The PUDIC ARTERY, where it lies covered by the tuberoſity of the iſchium.

DISTRIBUTION OF THE PUDIC ARTERY.

7. EXTERNAL HÆMORRHOIDAL ARTERY.
8. PERINEAL ARTERY.
9. TRANSVERSALIS PERINEI.
10. The ARTERIA PENIS, the diviſions of which cannot now be ſeen:—Theſe, however, go to the bulb (the extremities of which are ſeen at 11)—to the body of the penis—to the cavernous body of the urethra.
12. The CORONARY VEINS of the neck of the bladder.

INFERENCES DRAWN FROM THESE SEVERAL VIEWS OF THE PARTS.

OF THE ACTION OF THE PERINEAL MUSCLES.—There is no combination of muſcles more curious, or more deſerving of our attention, than that of the muſcles of the penis and rectum; whether we conſider the importance of the organs to which they are ſubſervient, or the diſeaſes with which they are connected:—yet both the natural action of thoſe muſcles, and their action and ſympathies in the morbid ſtate of the

Plate X.

Fig.e 1.

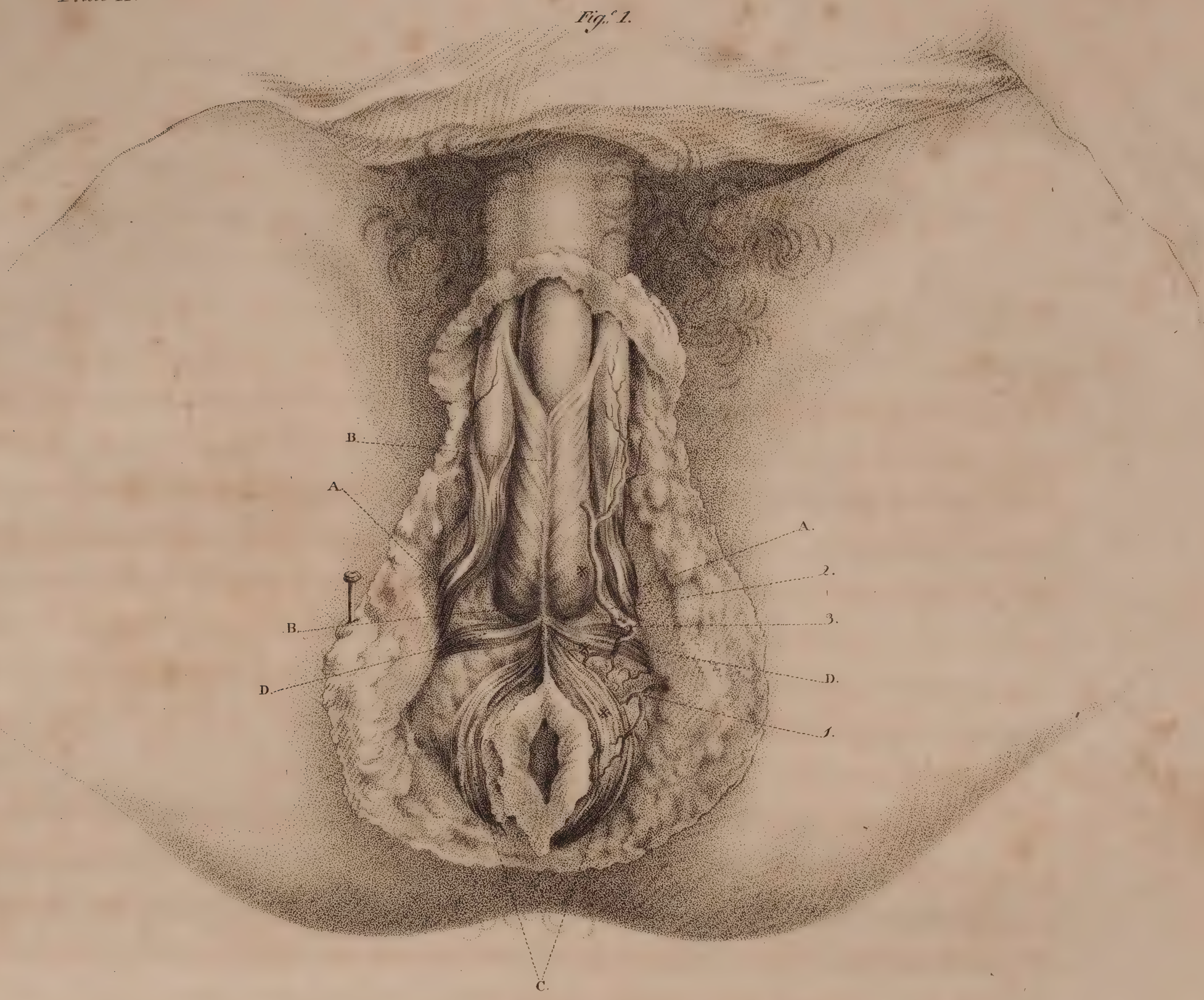

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Fig. 2.

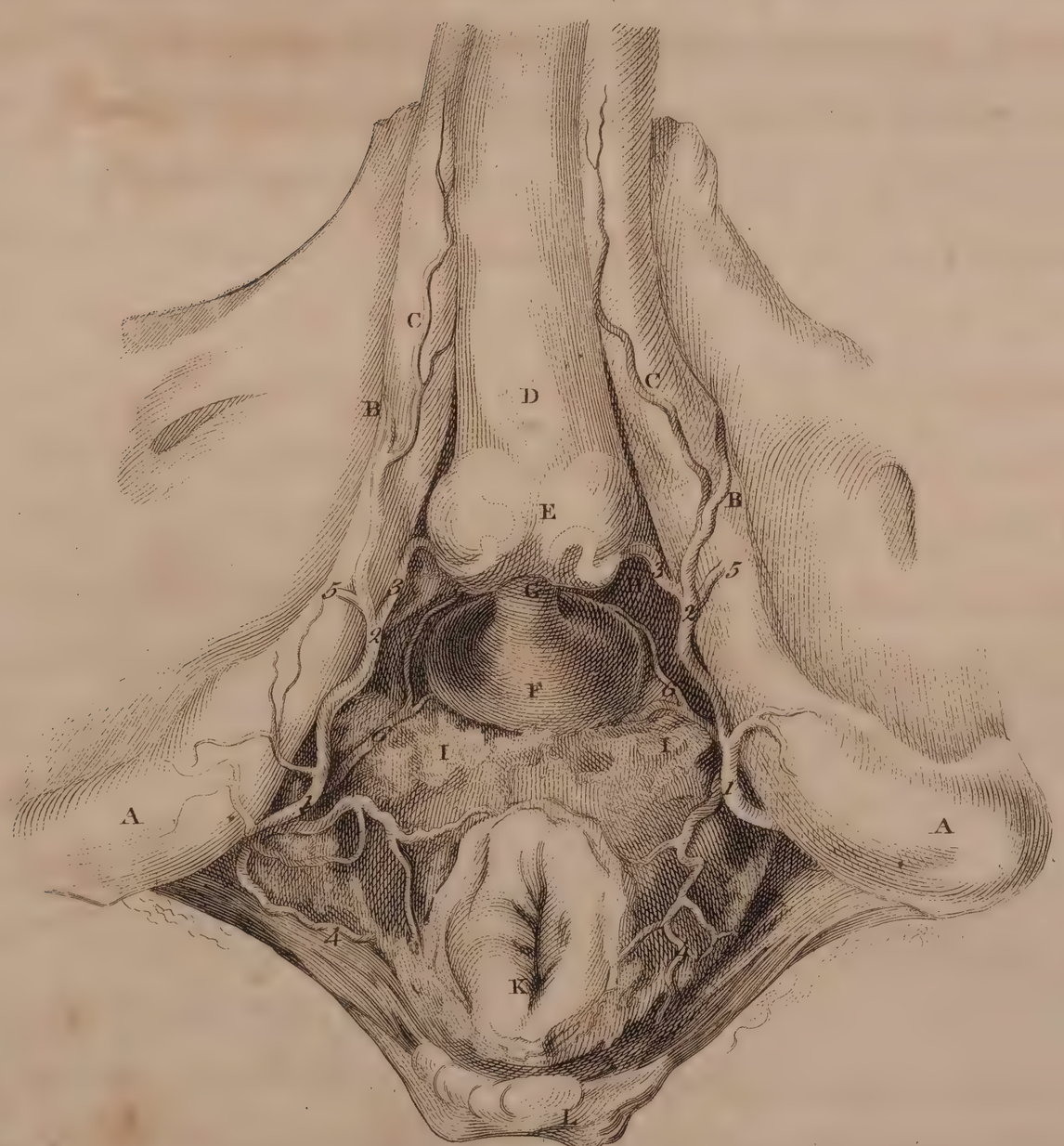
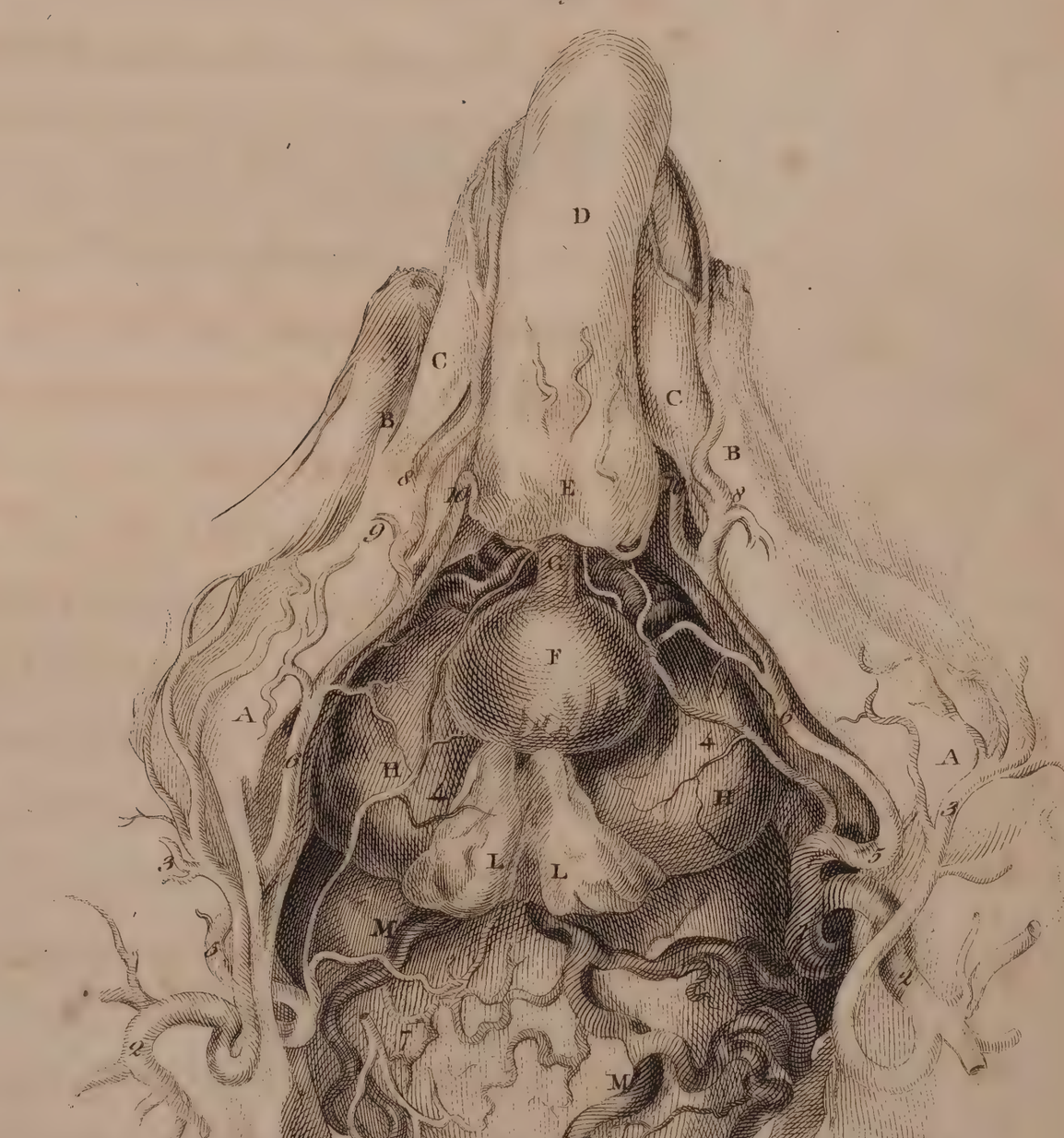


Fig. 3.



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parts, have been much neglected; and the uſes or actions attributed to them are ſurely very far from the truth.

Of the erector penis.—Is it not more natural to conceive that the uſe of this muſcle is to brace the crura penis to the bone, than to adopt that explanation of its action which has gained it its preſent name? Can we conceive any mechaniſm ſo well adapted to give firmneſs and occaſional ſtrength to the hold which the root of the penis muſt have upon the bone, as that of a muſcle partaking of the ſame ſtimulus; inert when the penis is flaccid, and rouſed to action in proportion to the excitement of the penis?—To ſuppoſe it aſſiſting the dilatation of the penis, by forcing the blood forward from the crura, is to attribute to it an action which would totally prevent erection; ſince the crura could have no hold upon the os pubis. And the idea of its holding down the penis is (in ſpite of authority) ridiculous; ſince the pubes or adipoſe membrane betwixt the dorſum penis and os pubis prevent further elevation, and render ſuch an action in this muſcle unneceſſary.

Accelerator urinæ.—To underſtand the action of this muſcle, we muſt recollect the relations of the bulb and lower portion of the cavernous body of the urethra upon which it acts. The corpus cavernoſum urethræ is a ſpongy body, ſurrounding the urethra from its membranous part under the arch of the os pubis to the glans. The glans is the enlargement of this body towards the extremity of the penis, whilſt its lower part in the perineum is alſo enlarged to form the bulb. Within this lower part the canal of the urethra is dilatable into what has been called the sinus urethræ. Now this is ſtrictly the operative part of the penis, and is raiſed upon the firmer ſupport of the body of the penis, which alone, by its crura, has a firm hold of the os pubis. When the glans is excited, the whole parts of generation are brought into action:—the veſiculæ ſeminales more gradually empty themſelves into the urethra; when the accelerator, being drawn into action, propels their contents forward by ſucceſſive pulſations. It may be obſerved, too, that this action upon the bulb, though partial, affects the whole extent of the cavernous body of the urethra, and has the effect of ſtrengthening and making rigid that canal, ſo as to increaſe the velocity of the emiſſion.

The erector and accelerator muſcles are the only ones which can be conceived to have an independent action; and the accelerator is very ſtrictly connected with the tranverſalis and ſphincter ani. In that action of the accelerator which has been noticed, the ſphincter ani, the tranſverſalis perinei, and the levator ani have a ſimultaneous action. The two firſt retain and ſteady the bulb of the urethra againſt the action of the accelerator; whilſt the levator ani, and muſcular fibres about the neck of the bladder, compreſs the veſiculæ, and, conſtricting the urethra, prevent a retrograde movement of the ſemen. Beſides the action of aſſiſting the muſcles of generation, the ſphincter, tranſverſalis, and levator ani muſcles, have the peculiar action of guarding the outlet of the pelvis; and give to the contents of the pelvis firmneſs and a degree of ſupport, enabling them to preſerve an equilibrium with the parts in the belly.

Diseased action in these parts affecting the discharge of semen.—Whilſt treating of the action of theſe muſcles, the diſeaſes with which they are connected form an important object; for though they are of rare occurrence, they are very intereſting. An encreaſed ſecretion from the veſiculæ ſeminales, or proſtate gland, is frequently a cauſe of terror to patients, when there really is no diſeaſed ſecretion of the ſemen.

In an inſtance of retention of the ſemen, theſe are the ſymptoms: "Ni ce fremiſſement ni cette ſenſation ne ſe ſoutenoitent pas auſſi long tems. La ſemence ne ſortoit qu'en forme de bave, et a meſure que l'erection diminuoit (a)." We may explain ſuch ſymptoms thus: The ſemen was not thrown retrograde into the

(a) See Mem. de l'Acad. de Chiriurgie.

bladder; for in that caſe it would have been evacuated only by an effort to make urine: but there being ſuch an obſtruction as to retard the veſiculæ ſeminales from diſgorging themſelves ſuddenly into the urethra, ſo as to diſtend and ſtimulate the accelerator muſcle, the ſemen remained ſlowly moving through the urethra: or, what is more probable, the erection of the penis and ſpaſmodic contraction of the muſcles were ſuch as to obſtruct the paſſage of the ſemen until the relaxation of all the parts; a diſeaſe in which our expectation of relief is much better founded, than when there is an obſtruction in the canal of the urethra. Much the ſame ſymptoms, I believe, are the conſequence of ulcers having partially deſtroyed the accelerator muſcle, when the power of expelling the ſemen from the ſinus urethræ is loſt.

Where the ſemen, inſtead of being thrown forwards, really falls backwards into the bladder, it may be difficult to ſay whether it may be owing to a relaxation of the muſcular fibres ſurrounding the neck of the bladder, allowing to the ſemen a retrograde movement into the bladder, or whether it be owing to an obſtruction before the verumontanum. The former is more likely, ſince ſuch a retention of the ſemen is not accompanied with any interruption of the natural diſcharge of urine.

But there is a circumſtance which may ſtill farther explain the peculiarity in the evacuation of the ſemen: Whilſt it flows, the ſtate of the parts muſt be recollected, the tenſion, the fulneſs, during the venereal orgaſm. In this ſituation of the parts, any caruncle or prominent obſtruction ſuffers a kind of erection, whilſt the canal is at the ſame time ſtraitened. This may explain a circumſtance which occurred in a caſe where the ſemen was thrown back into the bladder. The patient could not evacuate the urine; and when, after a few minutes, it flowed, the ſemen was found ſettled in the chamber-pot. It has happened frequently, that mucus evacuated by ſtool in teneſmus has alarmed patients much, in a diſeaſe of this nature; as they immediately conceive this to be the ſemen coming by ſome ſtrange preternatural paſſage.

In ſtricture of the urethra, where the urine flows with difficulty, it is curious that the ſemen is diſcharged naturally. But we muſt make a diſtinction betwixt an obſtruction to the ſemen before it reaches the accelerator muſcle, and one ſituated betwixt that muſcle and the glans. Beſides, the urethra in erection of the penis is much ſtraitened and elongated; ſo that a ſtricture, which is firm and callous, and not apt to be affected by the fulneſs of the parts, ſhould give comparatively little reſiſtance, eſpecially when we conſider that the ſtretching of the urethra by erection (which we endeavour to imitate in introducing the catheter) will in a greater meaſure counteract the ſtricture.

In that affection of theſe parts which is conſidered as SEMINAL WEAKNESS, an attention to their action and importance in the economy will perhaps explain the nature of the diſeaſe. I ſhould conceive, that the veſiculæ ſeminales receive the ſemen, not ſtrictly as reſervoirs; but that in theſe veſſels it may be mingled with their peculiar ſecretion, ſo as to form, when diluted, a quantity of fluid fitted to be acted upon by the muſcles of generation. Were the ſemen poured only from the vaſa deferentia, there would be too ſmall a quantity of fluid to be acted upon; nor would there be the ſame chance, nay, ſcarcely the poſſibility, of impregnation. We know, that the prolific power of the ſemen is not leſſened by dilution; and indeed we are aſſured, that by the violent excitements of the parts, the proſtate gland and all the mucus glands of the urethra contribute their ſecretions. By dwelling upon this, it is meant to point out the diſtinction betwixt thoſe affections of the parts which are conſidered as ſeminal weakneſs, and any real affection of the teſticle. Slight inflammations of theſe parts, weakneſs, or loſs of tone, the diſcharge from the urethra, or gleets communicating with the veſiculæ ſeminales or proſtate glands, will produce an increaſed ſecretion, a permanent or temporary laxity and debility of the ſecreting parts; and their contents being accumulated, will be thrown out in ſtraining at ſtool, or in the expulſion of the laſt drops of urine, without implying any peculiar affection of the ſecretion of the teſticle, or any more general debility of the ſyſtem.

OF ACTION IN THE RECTUM.—We ſhall perhaps come to admit, that a relaxation takes place in the ſphincter ani, if we conſider the manner in which the inteſtinal canal acts through its whole length. One portion

of the gut being in action, propels its contents to that which is below, and which, relaxing, receives them. Were there not a relaxation in the lower portion, it would oppoſe itſelf to the contraction of the upper part.

In the ſame manner, the ſuperior ſtrength of the muſcular fibres, ſurrounding the extremity of the rectum, is relaxed during the action of the rectum, which allows an eaſier expulſion of the fæces:—as, by a law of nature in parturition, not the muſcular parts only, but the whole parts, are relaxed previous to their dilatation. It is from this peculiarity in the action of the rectum that I would explain the formation of piles in ſome inſtances, and the prolapſus ani. Irritation of the gut gives occaſion to an almoſt imperceptible but conſtant effort to expel from the rectum; and this effort is attended with a relaxation of the lower part of the gut and of the muſcles, which, in action, retain the parts, and counteract the preſſure of the abdominal viſcera and the occaſional action of the abdominal muſcles. By continued action of this kind (the uſual tenſion being taken off), the parts ſwell by the influx of blood; the internal membrane is inflated with blood, and protruded, forming a ſpecies of the hæmorrhoes. The ſame explanation holds good in violent ſtraining at ſtool in coſtive habits; and it ſhould be recollected at the ſame time, that the contraction made higher in the rectum, may more eaſily retard the returning venous blood than the more active play of the hæmorrhoidal arteries.

Of INTERSUSCEPTIO AND PROLAPSUS ANI.—In the ſame manner we have to explain interſuſceptio and prolapſus ani. In the firſt inſtance, the gut being irritated at any point, the irritation cauſes a contraction, while in the ſuperior portion of the canal there is an effort to propel downwards: the conſequence is, that the portion contracted by the irritation is forced to ſlip into the lower portion of the canal. In irritable childhood this often happens; and I have frequently found upon opening children, that there were involutions of the gut without inflammation or adheſion, but which might be withdrawn by the mere weight of the inteſtine. In prolapſus ani, that laxity of the internal membrane, which is the immediate cauſe, is frequently produced by irritation; and the internal membrane being firſt protruded, the effort of expulſion being continued, the irritation increaſes, and a great part of the gut is inverted. When this accompanies dyſenteric affections or diarrhœa, where there has been violent teneſmus and bearing down, it is a moſt diſtreſſing ſymptom, eſpecially when the counter indications prevent the proper remedies. In caſes where there is local irritation (as from numerous aſcarides in the rectum of children, or, as ſometimes happens, from the ſtone in the bladder,) the temporary or permanent relief from the irritation muſt be the firſt object, while aſtringents are applied to counteract the effect of the loſs of preſſure. The reduction is commonly accompliſhed without difficulty by a ſtrong cone of paper ſoftened (by moiſtening at the point) and oiled. This is to be introduced into the gut with gentle but continued preſſure; and when the gut is completely reduced within the anus, the cone is eaſily withdrawn, with little riſk of its bringing down the inteſtine again. In violent irritation of the rectum, as in long continued teneſmus of deſentery, the neck of the bladder ſympathizes; and what produces relaxation in the gut cauſes a ſtranguary, or ſpaſmodic conſtriction in the neck of the bladder. This we ſhall readily conceive, when we recollect the ſtrict relation which ſubſiſts between the action of the rectum and of the muſcles about the neck of the bladder in their healthy action. The ejection of the contents of both is not allowed at the ſame time, but requires an alternation of action; which certainly is in a great meaſure to be accounted for from the communications of the levator ani, ſince this muſcle, ariſing from the brim of the pelvis, ſends its fibres down upon each ſide of the neck of the bladder, and embraces it before it reaches the lower portion of the gut, into which it is finally inſerted.

It may be obſerved here, that in all ſuch protruſions, whether hærnia or prolapſus ani, the moſt immediate bad conſequence is the want of accuſtomed preſſure upon the protruded part, which cauſes fulneſs

and ſtagnation of blood. In prolapſus, the contraction of the ſphincter and levator ani tend to increaſe the evil, by drawing like a ligature upon the protruded gut (B).

It is by ſuch a view of the parts as we have in fig. 2. that we come to have a truer idea of the ſtrict relation which they have to each other, of their ſympathies in diſeaſe, and of what we ſhould expect to feel in a morbid ſtate upon examining by the anus. Thus in inflammation of the neck of the bladder, or enlargement of the proſtate gland, the pain in making water—the frequent excitement to it—the pain ſtretching upwards to the kidneys, and extending along the penis to the glans—the pain upon preſſure in the epigaſtrium—the ſenſation in the rectum of a tumor, or of fæces ready to be expelled (which is occaſioned by the ſwelling of the proſtate gland);—do in ſome meaſure recapitulate to us the anatomy and ſympathies among the parts.

The ſtudent, in diſſecting theſe parts, ſhould naturally be led to inquire concerning the direction of abſceſſes which ſo frequently run amongſt the cellular ſubſtance; of ſuch particularly as may be connected with the urinary organs, the urethra, or neck of the bladder, and of the fiſtula in ano, or ſuch as run up by the ſide of the rectum.

Theſe abſceſſes, forming amongſt the cellular membranes, become habituated and ſtationary; being long callous canals, which, by the condenſation of the ſurrounding parts, acquire a ſmooth internal ſurface, and from which there is a perpetual diſcharge of matter. They are with difficulty brought to have any tendency to heal; and ſometimes communicating with the gut, teaſe the patient with a local irritation in the rectum, and waſte him with collequative diarrhœa.

We ſee evidently, from the numerous arteries here, how liable we may be to miſtake the moſt common indurated tumor for an aneuriſm, having a diſtinct pulſation communicated to it by its contiguity to theſe veſſels:—yet we have reaſon to be aſtoniſhed, that aneuriſm of theſe veſſels is not frequent, more eſpecially in the female pelvis, where the parts are ſo liable to diſeaſe, and where they are ſubjected to occaſional preſſure, dilatation, or ſudden relaxation.

Of LITHOTOMY.—Upon turning our attention to fig. 1. we find, that the external inciſion in lithotomy muſt run in the direction (***) upon the left ſide of the perineum, cutting directly through the tranſverſalis muſcle, cutting a few fibres of the ſphincter, and going deeper, or more penetrating in the middle, ſo as to reach into the membranous part of the urethra. In laying open the groove of the ſtaff, it is very aukward to cut the bulb of the urethra. It nevertheleſs does ſometimes happen, that it is not cut only, but minced with many tranſverſe cuts. And authors mention a more damning circumſtance ſtill, viz. the blood having been ſeen flowing from the anus, in conſequence of the inciſion having been carried too low upon the gut, and the gut and hæmorrhoidal veſſels cut.

It is a more frequent, and very embarraſſing accident, when the pudic artery is cut by carrying the knife too near the bone: the veſſel muſt be tied before proceeding. When the perineal artery is cut (and indeed it can hardly eſcape) it does not, in general, interrupt the operation.

Some or all of theſe veſſels bleed in the operation of lithotomy, and choak up the wound with coagulating blood; ſo that the operation muſt be done much more in the dark than we ſhould conceive from the view of the diſſected parts.—And this ſhould teach us how neceſſary a ſtrong conception of the anatomy is; not ſimply ſuch an idea as can enable us to diſſect the parts, but a knowledge of the feel alſo of the different parts, ſo as to be able to diſtinguiſh them by the finger.

A thickened and indurated ſtate of the bladder has been a frequent cauſe of the failure of this operation: For although, when the gorget is ſaid to have gone betwixt the bladder and rectum, it is generally

(B) The conſideration of the diſeaſes of theſe parts is reſumed in a ſubſequent Section.

Fig. 1.

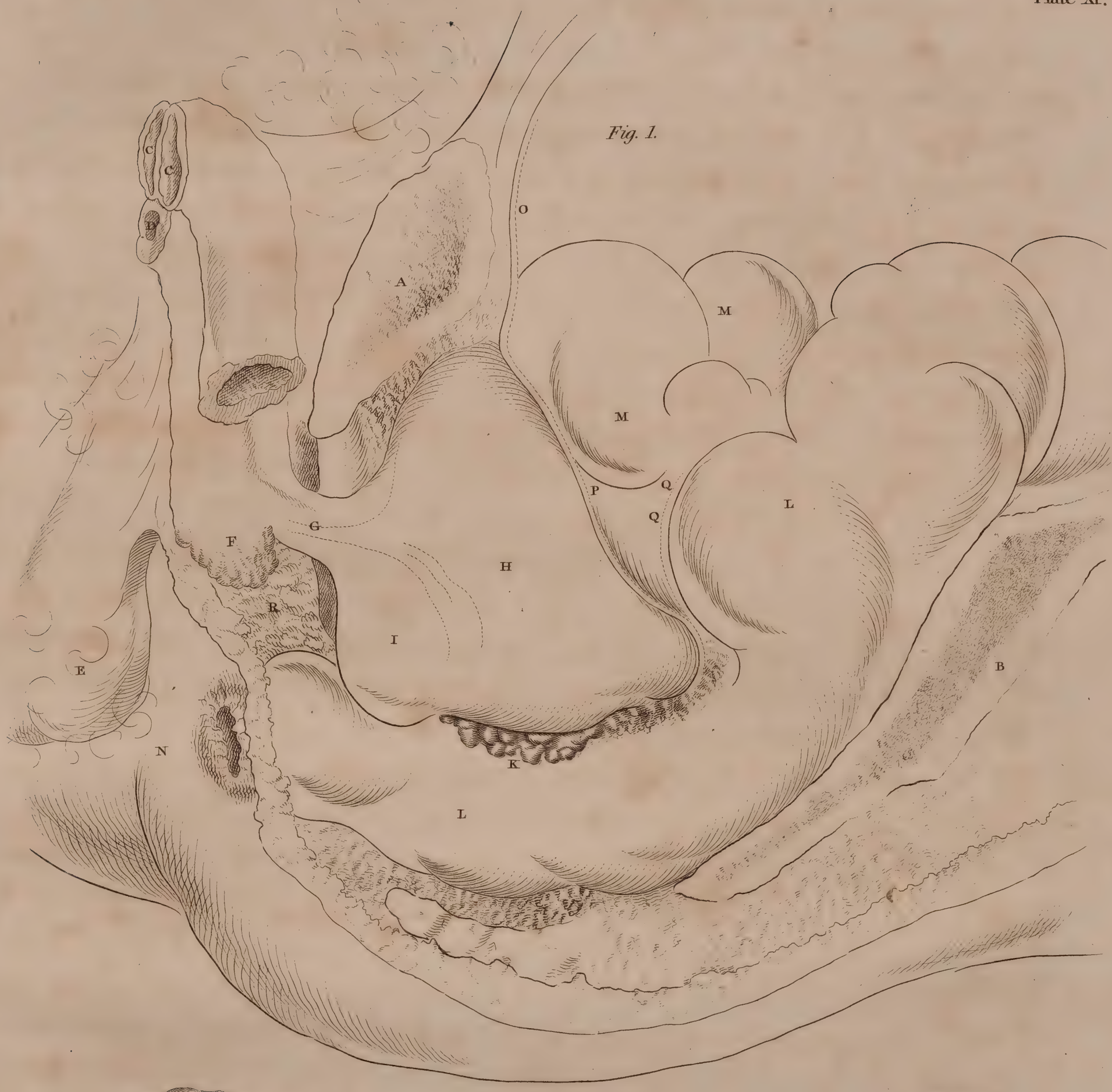
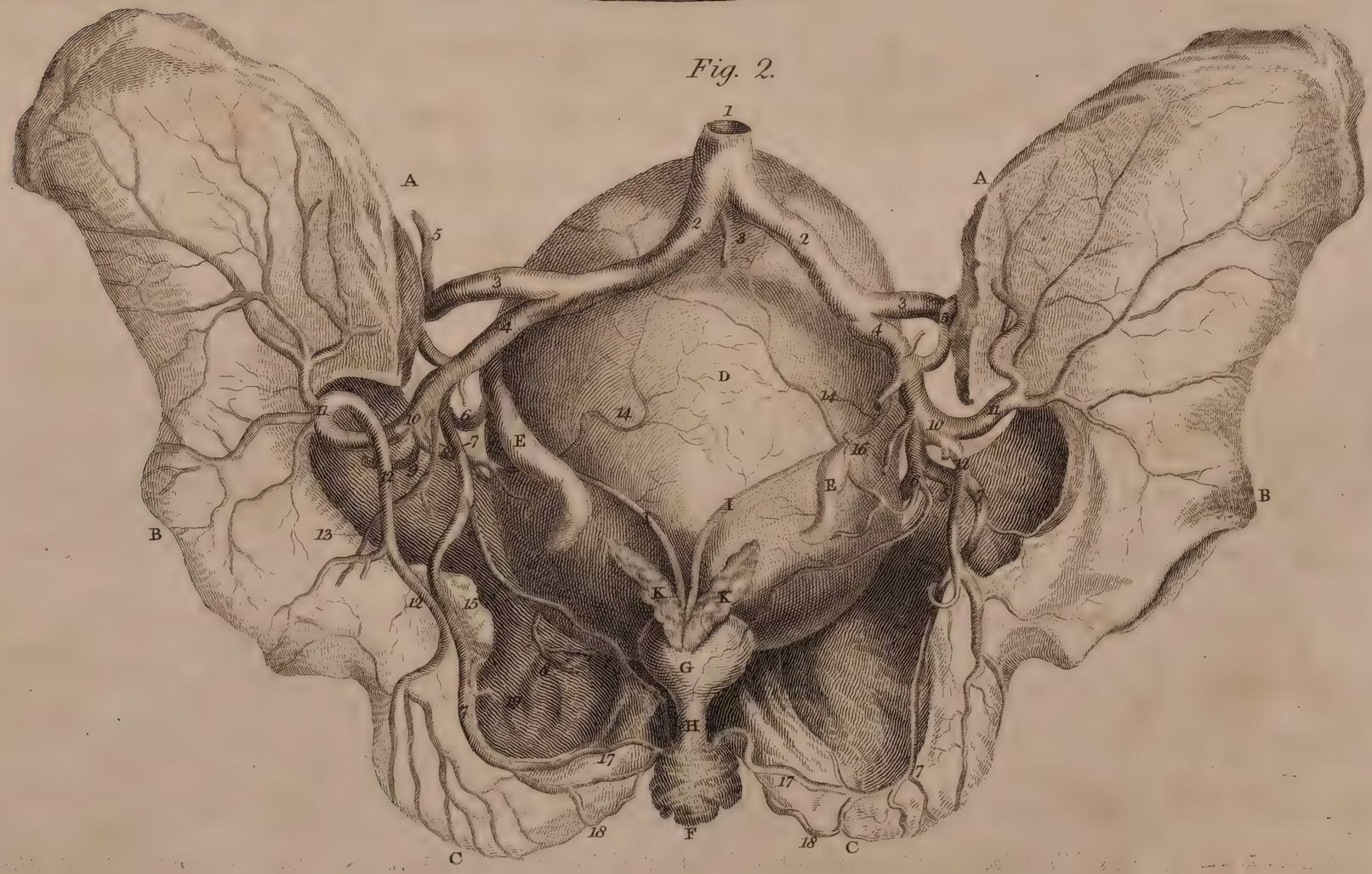


Fig. 2.



Drawn by Chas. Bell. *Pubd. as the Act directs for C. Bell Edinr. 1799.* *Engd. by T. Grant*

conceived that the operator, in his hurry and trepidation, has never fairly cut the urethra and groove of the ſtaff, but has paſſed his gorget onwards, unguided, amongſt the cellular ſubſtance; yet it would appear more likely, that in this caſe the bladder had been puſhed forwards upon the ſtaff by the gorget, without the inſtrument having penetrated the bladder, or cut through the proſtate gland.

OF THE SECTION OF THE PELVIS.

EXPLANATION OF PLATE XI. FIG. 1.

In the rude plan of the ſection of the pelvis given in Plate XI. fig. 1. and which is taken with little variation from Camper, it is ſuppoſed to be cut by the ſymphyſis of the os pubis (A), and the ilium (B) at an equal diſtance betwixt its ſymphyſis with the ſacrum and the acetabulum. We muſt be aware of the confuſion of parts which this preſents, and that it is a tedious and difficult diſſection clearly to demonſtrate all the parts; the bladder, urethra, proſtate gland, veſiculæ ſeminales, ureters, and rectum, with their connections, even without their blood-veſſels, and to retain them in their natural ſituation.

A, The OS PUBIS divided by its ſymphyſis.

B. The OS ILIUM divided.

C, The CORPORA CAVERNOSA PENIS.

D, The URETHRA, ſurrounded with the corpus cavernoſum urethræ.

E, The SCROTUM.

F, The BULB of the URETHRA.

G, The MEMBRANOUS PORTION of the URETHRA. In diſſecting here, we have to obſerve the ligamentous ſubſtance ſurrounding and ſtrengthening it, and how it is embraced by the ſphincter veſicæ.

H, The BLADDER, as deſcribed by Camper, falling into a triangular ſhape, the baſe of which reſts upon the rectum. The muſcular fibres of the bladder are very formally repreſented by ALBINUS, inſerted into the os pubis. CAMPER cannot diſtinguiſh this inſertion. The drawing of ALBINUS would miſlead us; ſince no ſuch regular muſcle is to be ſeen, and ſince the muſcular fibres are looſe and irregular, and involved in the connecting cellular membrane: But ALBINUS, in as much as relates to the origin and inſertion and general direction of the fibres, is invariably true.

I, The PROSTATE GLAND, which muſt be felt, not ſeen, amongſt the confuſion before diſſection.

K, The VESICULÆ SEMINALES attached to the lower part of the bladder, immediately behind the proſtate gland.

L, The RECTUM, taking the courſe of the os ſacrum and os coccygis.

M, The CONVOLUTIONS of the INTESTINES in the lower part of the belly.

N, The ANUS.

O P Q, A dotted line, repreſenting the courſe of the peritoneum. O, where it covers the abdominal muſcles and pubes;—P, where it is reflected upon the bladder;—Q, where it turns over the rectum, and forms its outer coat.

REVIEW OF THE PARTS AS SEEN IN THE SECTION OF THE PELVIS.

The BLADDER is, upon the upper and back part, covered with the ſmooth expanſion of the peritoneum;—on the lower and fore part, and contiguous to the lower portion of the rectum, it is imbedded in cellular membrane, in which abſceſs makes rapid progreſs. The bladder upon diſtention riſes before the inteſtines M, M, keeping cloſe to the pubes (A), and carrying the peritoneum (O, P,) before it; ſo as, when much

diſtended, to appear above the os pubis, and to allow of its being punctured, or even to permit the performance of the high operation for the ſtone without piercing the peritoneum. As it riſes, however, the lower part of the bladder does not proportionally protrude, but rather (in the ſubject) retires from the perineum as the bladder fills.

During diſſection, the place and degree of curve of the urethra ſhould be carefully obſerved, as of the laſt importance, in all operations in the perineum. It may be obſerved how ſtrongly the membranous part of the urethra, or that portion of it which is betwixt the bulb of the urethra and the proſtate gland, is ſupported by the faſciculus of fibres or ligamentum triangulare, and how much diſſection it requires to ſhew its membranous nature. In the healthy ſtate of the parts, it ſeems almoſt impoſſible that ſuch rudeneſs ſhould be employed as to rupture the urethra with the catheter; yet this happens in the diſeaſed ſtate of the parts. Such an accident, however, is more frequently the conſequence of continued preſſure of bougies; which being with difficulty directed in the curve of the urethra, make their way into the interſtice filled with cellular membrane (O), betwixt the neck of the bladder and rectum, and ſometimes into the rectum itſelf; forming a conſtant draining of urine into the rectum, and exciting in conſequence perpetual diarrhœa and teneſmus.

The PROSTATE GLAND (I), which is ſeen ſurrounding the neck of the bladder, when ſwelled by any of the cauſes enumerated below, compreſſes the canal of the urethra: but a more complete obſtruction to the introducing of the catheter ariſes from its ſwelling irregularly, or puſhing forwards, ſo as to increaſe the ſudden curve of the urethra, or to ſhift it aſide. In the ſame manner tumors, or even abſceſſes, by diſtorting the urethra, cauſe difficulty of paſſing urine. An inſtance of the diſtortion of the urethra cauſing retention, is the bladder being contained in the hernial ſac. But in this caſe, much of the difficulty of paſſing urine ariſes from a degree of weakneſs in the bladder itſelf, while it has alſo loſt the co-operating preſſure of the abdominal muſcles.

This outline of the ſection of the pelvis may illuſtrate another circumſtance much dwelt upon by Camper, viz. the point of the catheter being prolonged too far beyond that part of its curve which ſhould be adapted to the curve of the urethra:—the conſequence of this is, that when it is fully introduced, the point reaching the back part of the bladder puſhes it before it; and the coats of the bladder, clinging round the catheter, prevent the urine from flowing; or if the inſtrument be continued in the bladder, there is great riſk of the bladder being hurt by the point of the inſtrument.

It may be obſerved, too, how much of the bladder is under the curve of the ſtaff; how a ſtone gravitating into the lower part may be over-reached by the ſtaff or catheter, and no grating be felt but by forcing the convexity of the ſtaff downwards in ſounding. The ſtone falling into this more depending part of the bladder, in the prevailing poſture of the body, may form a lodgement here. This would undoubtedly more frequently happen, did the bladder always retain its natural pliancy and thinneſs of its coats; but the conſequence of the preſence and irritation of a ſtone in the bladder is a thickening and contraction of the coats, which muſt prevent the formation of cyſts.

In puncturing the bladder from the rectum, independently of the very aukward circumſtance of the canula remaining in the inteſtine, the proximity of the ſeat of diſeaſe (in the neck of the bladder or proſtate gland) becomes a great objection. We ſee alſo, from the plan, how in this operation the proſtate gland being enlarged it may be miſtaken for the bladder, and the trocar plunged into its ſolid ſubſtance, ſo that no urine can flow upon withdrawing the ſtilet.

In puncturing by the perineum alſo, we muſt recollect, that if the diſeaſe be in the proſtate gland, it is enlarged, and there is a great probability that the trocar ſhall be paſſed into the ſubſtance of the gland, and not penetrate into the bladder.

I have ſeen an inſtance where the trochar in this operation had paſſed through the urethra: upon withdrawing the ſtilet no urine flowed from the canula, becauſe it had transfixed the urethra (which had been

dilated behind the obſtruction); but upon withdrawing the canula a little, and freeing it from the oppoſite ſide of the urethra, the urine flowed in full ſtream. The canula upon this was further introduced again; but inſtead of taking its former direction, it ſlipped along the urethra, and found its way into the bladder by the natural paſſage. This appeared upon the diſſection.

In the ſubject, or in the annexed plan, we ſee how the bowels preſs down into the pelvis in the erect poſture of the human body: but we may obſerve alſo, how the viſcera of the pelvis, being more firmly connected by cellular membrane and conſtricting muſcles, ſupport the weight of the abdominal viſcera; that, by the combined power of the perineal muſcles, levator ani, coccygeus, and iliacus internus muſcles (the antagoniſts of the abdominal muſcles and diaphragm), the prolapſus of the parts is prevented: yet we can conceive in the female pelvis a hernia of ſome of the inteſtines, betwixt the vagina and rectum, forming a tumor puſhing down from the vagina; or here ſometimes a hernia may inſinuate itſelf betwixt the bladder and os pubis getting acceſs to the thyroid hole; nay, there are even inſtances of hernia protruding upon the hip from the ſacro-iſchiadic hole.

VIEW OF THE PELVIS FROM BEHIND; BEING AT THE SAME TIME A RECAPITULATION OF THE PRECEDING VIEWS OF THE PARTS.

EXPLANATION OF PLATE XI. Fig. 2.

In this ſubject, after a minute injection of the pelvis, the os ſacrum was taken away; the rectum alſo was diſſected away, that the bladder might be ſeen from behind, and a more comprehenſive view allowed of the diſtribution of the INTERNAL ILIAC ARTERY. The branching of the arteries here are not what will be conſidered as regular; but it is better to take a ſelection of Nature's chooſing, and draw accurately, while the more general diviſion of the branches are thrown into a ſcheme.

A A, OSSA ILIA.

B, ACETABULUM.

C, TUBEROSITY of the OS ISCHIUM.

D, The BLADDER of urine diſtended.

E, The URETERS.

F, The BULB of the urethra.

G, The PROSTATE GLAND.

H, The MEMBRANOUS PART of the URETHRA.

I, The VAS DEFERENS.

K, The VESICULÆ SEMINALES, as they appear in a boy when injected with mercury.

ARTERIES.

1. The AORTA; the rectum having been diſſected out from betwixt it and the bladder.
2. The COMMON ILIAC ARTERIES.
3. The EXTERNAL ILIAC ARTERY going to the thigh.
4. The INTERNAL ILIAC or HYPOGASTRIC ARTERY.
5. The ILIO-LUMBAR ARTERY.
6. The HYPOGASTRIC ARTERY, or umbilical artery of the fœtus, pervious now only ſo far as to ſupply arteries to the bladder.
7. The PUDIC ARTERY (or EXTERNAL HEMORRHOIDAL) coming off in the ſame trunk with the laſt.
8. The THYROID ARTERY.
9. A branch from the thyroid artery penetrating the bone.
10. A trunk common to the GLUTEAL and ISCHIADIC ARTERIES.

11. The GLUTEAL ARTERY, or ILIACA POSTERIOR, where it comes out from the pelvis, branching largely on the back part of the os ilium.

12. The ISCHIADIC ARTERY.

To demonſtrate theſe two laſt arteries is an important diſſection, which will be more dwelt upon in that part which contains the diſſections of the thigh.

13. A branch going to the gluteal muſcles and great ſchiadic nerve, and from which one of the lateral ſacral arteries goes off.

14. A branch from the umbilical artery to the bladder, anaſtamoſing with others upon the upper part of the bladder.

15. VESICALIS IMA.

16. SACRÆ LATTERALES cut ſhort.

BRANCHES OF THE PUDICA COMMUNIS IN THE PERINEUM.

17. DEEP SEATED BRANCH of the PERINEAL ARTERY.

18. SUPERFICIAL BRANCH or ARTERIA PERINEI.

19. HÆMORRHOIDAL VEINS going to the ſkin and fat about the anus.

SCHEME OF THE ARTERIES OF THE PELVIS.

AORTA.

Sacra media.—ILIACA COMMUNIS—.Lumbalis ima.

Iliaca externa.—ILIACA INTERNA or hypogaſtrica.

While the external iliac goes down to the thigh the internal iliac, gives off the following branches:

Obturator; which ſometimes gives off the ilio-lumbalis.

Iliaca poſterior gives off { Sacræ laterales, / Ilio lumbalis, / Obturator. } ſometimes.

Iſchiadica; which ſometimes gives off the Obturator.

Pudica; giving off { Veſicalis ima, / Arteria proſtata, / Hæmorrhoidea media; this frequently from the hypogaſtrica. / Hæmorrhoidea externa. / Arteria perinæi—Tranſverſalis perinæi. / Arteria penis. }

Umbilicalis; in the female giving off { Arteria uterina. / Ramus ad veſicam. / Hemorrhoidea media—branching to the { Rectum, / Vagina, / Bladder, }

ANOTHER ARRANGEMENT.

Internal iliac.

Gluteal. Iſchiadic,

Ilio lumbalis, ſacro lateralis. Umbilicalis, pudica, obturator.

SCHEME OF THE ARTERIES OF THE RECTUM.

The ſuperior hemorrhoidal artery, which is the deſcending branch of the inferior myſenteric.

The middle hemorrhoidal, from the pudic artery within the pelvis.

The external hemorrhoidal, from the pudic artery, where it appears without the pelvis, Plate X. fig. 3. 5.

OF THE DESCENT OF THE TESTICLE; OF THE MANNER OF DISSECTING; AND OF THE DISEASES ILLUSTRATED BY THIS PIECE OF ANATOMY.

The deſcent of the teſticle in the fœtus is, in a phyſiological light, extremely curious, and almoſt inexplicable as a piece of anatomy. It is with ſome difficulty comprehended at firſt, but worthy of our utmoſt attention, as illuſtrating many important diſeaſes; hernia, hydrocele, and all diſeaſes of the teſticle, chord, and abdominal ring.

EXPLANATION OF PLATE XII.

I ſhall here endeavour to throw together the explanation of the figures and of the method of diſſecting. In a recapitulation, I ſhall point out the circumſtances chiefly worthy of inveſtigation, and the complication of the more ſimple anatomy in hernia, hydrocele, &c.

FIG. 1.—This was a diſſection of a fœtus of ſeven months; at which time, in general, the teſticle will be found adhering juſt without the ring, as was the caſe in the other groin of this ſubject. The angular flap of the abdominal muſcles of the right ſide being laid down over the thigh, the inteſtines removed, and the ring of the abdominal muſcles diſſected, the parts appear thus:

A, The BLADDER pulled aſide by a ligature upon the umbilical arteries.

B, The UMBILICAL or HYPOGASTRIC ARTERY of the right ſide.

C, The RECTUM. Both the bladder and rectum, it may be obſerved, ſtand high and almoſt out of the pelvis, the whole contents of the pelvis falling lower in the adult.

D, The PENIS.

E, The SCROTUM as yet without the teſticle.

F F, The ABDOMINAL MUSCLES.

G, The BODY of the TESTICLE.

H, The EPIDIDYMIS. The teſticle is here approaching the ring; having deſcended from its priſtine ſituation immediately below the kidney and upon the pſoas muſcle.

I, The SPERMATIC ARTERIES and VEINS, and (as may be ſeen in fig. 2.) without either the vas deferens or the cremaſter muſcle.

K, The GUBERNACULUM TESTIS covered by the peritoneum.

L, The PERITONEUM, diſſected off the abdominal muſcles F F.

M, The PROCESS of the PERITONEUM, which, being prolonged through the ring of the abdominal muſcles, is loſt among the cellular ſubſtance in the groin N.

I hope it will be ſufficiently underſtood how the teſticle G is ſaid to be without the peritoneum, *i. e.* behind it; for it lies at preſent in the ſame circumſtances with regard to it as the rectum.—C, the peritoneum, being ſtretched over its fore part, and adhering to its ſubſtance, forming the TUNICA ALBUGINEA. The teſticle ſtill continuing its deſcent, by the ſhortening of the Gubernaculum K (ſee more diſtinctly fig. 2.); and the inflections of the peritoneum ſtill retaining their relation to the teſticle, it falls gradually into the ſac N, which becomes thus a ſecond coat to the teſticle, the VAGINAL COAT. As the ſurface of the peritoneum retains its lubricating ſecretion, theſe two coats do not adhere, but the outer or vaginal coat

ſimply embraces without adhering to the innermoſt or tunica albuginea. It will be at once underſtood, that this is a delicate piece of diſſection.

EXPLANATION OF FIG. 2.

The ſecond figure is a further diſſection of the ſame parts.

A, The BLADDER,

B, The UMBILICAL ARTERY.

E, The PENIS.

F, The ABDOMINAL MUSCLES laid down over the haunch, and diveſted of the peritoneum.

G, The TESTICLE.

H, The EPIDIDYMIS, ſtill covered by the peritoneum; it being impoſſible to diſſect it off.

I, The SPERMATIC ARTERIES and VEINS coming down to the teſticle, and diveſted of their peritoneal covering.

K, The GUBERNACULUM TESTIS, with the peritoneum diſſected off in its whole length. This is conſidered as of a ligamentous nature, but has no appearance of a ligament; it is ſeen much crowded with veſſels after a minute injection, and its fibres are apparently muſcular. It is impoſſible to demonſtrate here how the cremaſter muſcle is reflected upon it.

L, The VAS DEFERENS, ſeen going down behind the bladder, and betwixt it and the peritoneum.

M, The PERITONEUM diſſected back from part of the bladder, and from the veſſels of the teſticle, ſhowing how they lie behind that membrane.

EXPLANATION OF FIG. 3.

In the third figure we have a view of theſe parts after the full deſcent of the teſticle; but the parts ſtill retain their original features. To lay open this view, the parts were diſſected thus: The peritoneum was raiſed from the inner ſide of the abdominal muſcles; the proceſs of the peritoneum (Q), which ſtretches down through the ring, forming the two coats of the teſticle (like the pericardium upon the heart), was ſtill open; or, in other words, you could inſinuate a probe from the cavity of the abdomen, down betwixt the tunica vaginalis (Q) and the tunica albuginea (P). This proceſs of the peritoneum, then, being gently ſtuffed with cotton, the parts were put into ſpirits to harden. After a few days the diſſection was reſumed. The vaginal coat (Q) was cut, ſhowing the teſticle (P) lying on the back part, as in congenital hernia or hydrocele, and covered by the tunica albuginea; that is, as it lies in fig. 1. G, covered by a ſingle layer of the peritoneum. The peritoneum was then diſſected off the loins, and folded over towards the bladder (G H), in order to ſhow how the ſpermatic veſſels, nerves, and vas deferens, run down behind the peritoneum until they gain the teſticle.

A, The BLADDER pulled aſide.

B, The TWO UMBILICAL ARTERIES cut acroſs.

C, The RECTUM.

D, The SCROTUM.

E, The PENIS.

F, The THIGH.

G H, A portion of the PERITONEUM, which covered the ſpermatic veſſels, held aſide.

I, The URETER going down by the ſide of the rectum.

K, The COMMON ILIAC before giving off the hypogaſtric B.

L, The ANTERIOR CRURAL NERVE; twigs are ſeen going to the groin and ſpermatic chord.

M, The FEMORAL VEIN.

N, The SPERMATIC ARTERIES and VEINS, going down to the teſticle behind the peritoneum.

Fig. 1.

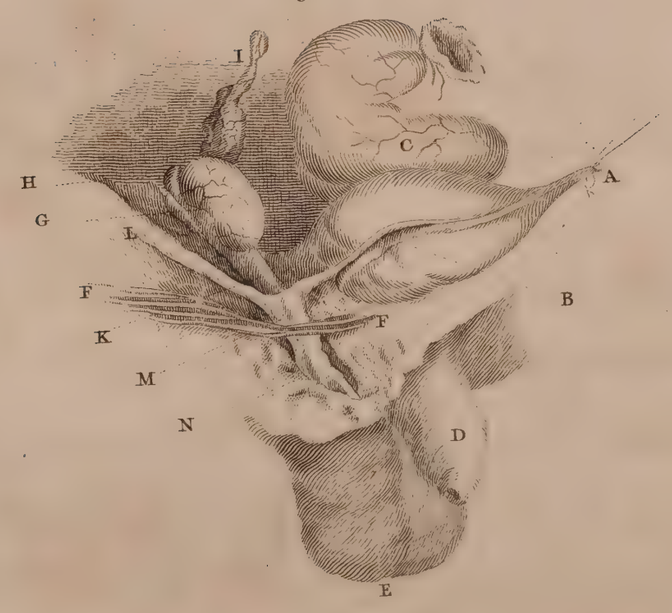


Fig. 2.

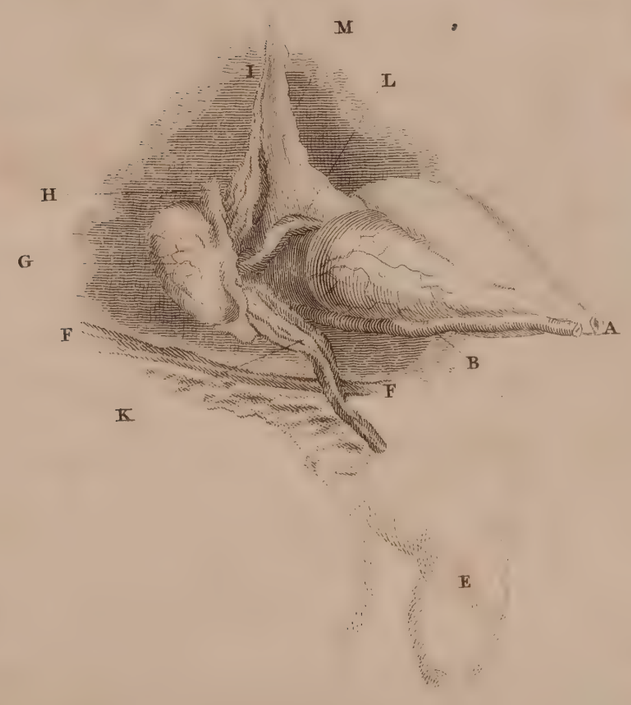


Fig. 3.

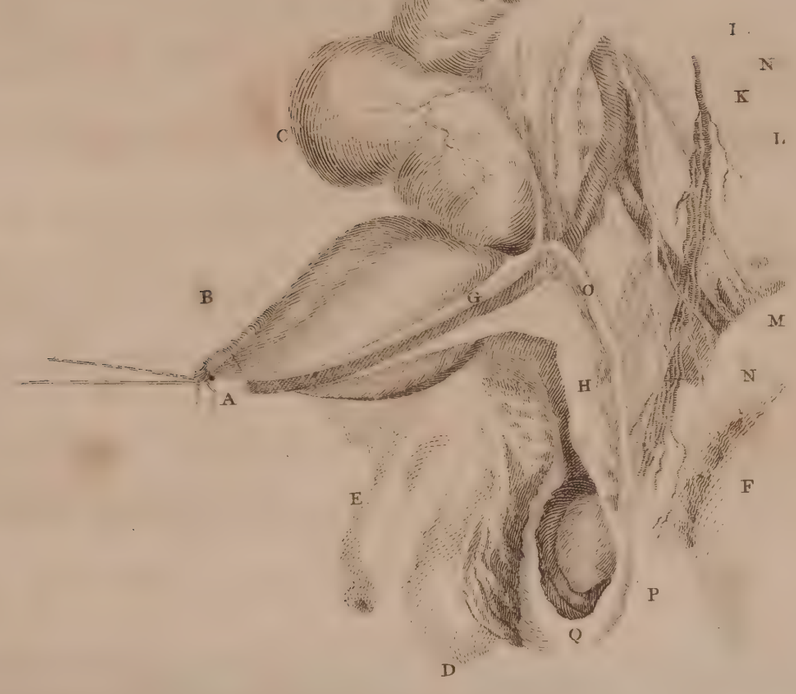


Fig. 4.

Drawn by Chas. Bell. *Pubd. as the Act directs for C. Bell Edin.r 1799.* *Engd. by J. Grant.*

O, The VAS DEFERENS; where it turns over to deſcend to the veſiculæ ſeminales.

P, The TESTICLE covered only by the tunica albuginea.

Q, The TUNICA VAGINALIS ſlit up, and ſeen communicating with the cavity of the belly.

THE COATS OF THE TESTICLE OF THE ADULT, AND SOME OF ITS DISEASES, ILLUSTRATED FROM THE ANATOMY OF THE TESTICLE IN THE FOETUS.

CAUSE OF THE DESCENT OF THE TESTICLE.—It is utterly impoſſible to account for the deſcent of the teſticle by any mechanical action, by the preſſure of the abdominal muſcles, by the periſtaltic motion of the inteſtines, by the generation of wind in them, or by gravitation:—for the fœtus lies in the womb with the head downwards, the abdominal muſcles are quieſcent, and the probability of occaſional inflation in the inteſtines of the fœtus is very ſmall. Beſides, any general preſſure would, at all events, more probably act upon ſome of the looſer viſcera, and produce rather a hernia than the regular deſcent of the teſticle.

The action of the gubernaculum (K, fig. 1. and 2.) is the more natural explanation. It guides the teſticle into its deſtined lodgement, and probably ſolicites it by a gentle action. Yet this action is unlike the action of other muſcles, being unremitting whilſt the teſticle is within the belly; and when the teſticle is arrived without the groin, a relaxation muſt take place, allowing the teſticle to deſcend into the ſcrotum. It is worthy of remark, that neither the ſpermatic veſſels (I) nor the vas deferens (L, fig. 1. and 2.) appear as if elongated or ſtretched, but retain their peculiar tortuous waving figure. Under the title of GUBERNACULUM TESTIS the fibres of the future cremaſter muſcle are included; and perhaps this muſcle has the chief action in bringing down the teſticle. The fibres of this muſcle are with difficulty demonſtrated in the human fœtus; but from comparative anatomy, it is found that it is reflected from its origin from the tranverſalis abdominis upwards, following the gubernaculum. In this ſituation of the parts in the fœtus, the cremaſter muſcle muſt lie behind the peritoneum; but in the adult, as that ſide of the peritoneum, which is contiguous to the pſoas muſcle, becomes in the ſcrotum the outer ſurface of the peritoneum which covers the chord, the cremaſter becomes an outward layer of fibres embracing the chord. The exit of the teſticle through the abdominal ring is certainly facilitated by the gubernaculum as a preculſor. It altogether forms a body of a wedge ſhape or pyramidal form (its baſe being upon the teſticle) which muſt gradually dilate and fill up the abdominal ring. When the teſticle is as yet far up upon the loins, the gubernaculum is ſlender; by its contraction it becomes thicker; and before the teſticle has arrived at the outlet, it ſcarcely forms a larger body than the contracted and thickened gubernaculum which has preceded it.

SITUATION OF THE TESTICLE IN ITS FULL DESCENT.—As the teſticle deſcends, the proceſs of the peritoneum accompanying it changes by inſenſible degrees. Though we ſee in a child upon one ſide the teſticle lying behind the peritoneum like the other viſcera of the abdomen, yet upon the other ſide, if the teſticle have fully deſcended, we ſhall have ſome difficulty (from the additional layers of cellular membrane it has acquired) in diſſecting the veſſels (N, fig. 3.), from the peritoneum (H), to ſhow that the veſſels run down behind the ſac to ſupply the teſticle. Shortly after the deſcent, the prolonged ſac of the peritoneum coaleſces and ſurrounds the ſpermatic chord, now compoſed of the ſpermatic veſſels (I, fig. 2.), the vas deferens (L), and the muſcular fibres (K). Theſe form one meſh;—ſo that no paſſage remains pervious from the cavity of the abdomen down betwixt the tunica vaginalis (Q) and the tunica albuginea (P). Mr Hunter was of opinion, that in thoſe caſes where the teſticles remain in the belly, the teſticles are diminutive and more imperfect than thoſe which deſcend into the ſcrotum. But the ſmallneſs of the teſticle may as probably be the conſequence of its remaining in the belly as the cauſe of its delay; and the teſticle may require to deſcend into the ſcrotum to receive its perfect action and tone.

Of CONGENITAL HERNIA.—How widely different the cauſes of the deſcent of the teſticle are from thoſe of a rupture, appears from the rarity of the occurrence of the congenital hernia, or the paſſing down of a portion of the inteſtine alongſt with the teſticle. This is very remarkable, when we conſider that a turn of the inteſtine is not larger than the teſticle to which it lies contiguous, and that the teſticle remains long in the very ring dilating it; yet by the peculiar mechaniſm and interlacing of the fibres of the ring, the inteſtine is not allowed to follow. Indeed, many are of the opinion of the celebrated Wriſberg, that the congenital hernia does not happen but by a previous adheſion of ſome of the inteſtines to the body of the teſticle, by which it is drawn down alongſt with it. Wriſberg found the ring, in ſeveral inſtances, ſo wide, and the parts ſo lax, as eaſily to allow the deſcent of a portion of the gut or omentum; yet in theſe caſes there was no hernia. Again, he found in other young ſubjects, where the teſticle ſtill remained in the belly, that it had contracted adheſions with the omentum. And, laſtly, he found in a caſe of old congenital hernia (upon opening the belly), that a portion of the omentum ſeemed to be attached to the ring; but upon further diſſection, he found it continued down through the ring, and adhering to the tunica albuginea of the teſticle. In other caſes, he found the teſticle ſo connected with the inteſtinum cæcum, that in pulling the one either way the other followed. And, what he conceives to be a convincing proof, he found in one ſide of a ſubject a faſciculus of fibres attached to the teſticle, and incloſed in a duplicature of the peritoneum; while, on the other ſide, though the ring was ſo wide as to allow the finger to ſlip in, there was no hernia. From theſe facts, he conjectures that the congenital hernia is, for the moſt part, formed in conſequence of adheſions betwixt the teſticle and viſcera; and that the inteſtines or omentum are, in conſequence, drawn down alongſt with the teſticle. It is a curious circumſtance, if fully proved, that the teſticle not only moſt unaccountably comes down into the ſcrotum, but that its tendency thither is ſo great as to pull down the inteſtine, and elongate the meſentery alſo.

It would be an idle repetition to point out the method of diſſecting and inveſtigating the congenital hernia, ſince the circumſtances of its anatomy, and its character and peculiarities, have been already detailed. The appearance of the more common rupture may perhaps be more opportunely illuſtrated here.

Of INGUINAL HERNIA.—Though the abdominal ring be preternaturally wide, if the teſticle ſhall have deſcended naturally, and the peritoneal ſheath cloſed, hernia congenita is for ever prevented; but if, upon any unuſual exertion, a portion of the inteſtine ſhall be forced through the ring, the old ſheath is not opened, but a new ſac of the peritoneum is forced down; and though it take the ſame courſe with the teſticle, it ſtill, in all its ſtages, remains detached and in a diſtinct proceſs of the prolonged peritoneum.

Of THE METHOD OF DISSECTING HERNIA.—To explain the appearances of the abdominal ring and ſac, I ſhall follow the method by which I gained my information, truſting that I ſhall always be ſimple and intelligible in the deſcription, while the idea is correctly fixed in my own mind.

In an old caſe of hernia, and where the patient's death has not been occaſioned by the rupture, the ring is wide, the inteſtine looſe in its ſac, and the teſticle lax, hanging far down, and often much waſted. Upon laying open the integuments, the peritoneal ſac of the hernia comes into view; and when the chord and teſticle are extricated in their full length, the preternatural ſac has no marked limits, but ſeems gradually to coaleſce with the chord, being enveloped in looſe cellular membrane and adventitious veſſels. Upon diſſecting up towards the abdomen, we find no ring, but the ſac of the hernia gradually blended with the tendon of the external oblique muſcle (Plate XII. fig. 4.); which, ſtretching over the neck of the ſac, is ſo cloſely mingled with it, that it is only diſtinguiſhable from it by the whiteneſs of its encircling fibres. To demonſtrate further this preternatural connection, we lay open the belly, and examine the ſtate of the viſcera and the portion of gut protruded; we diſſect carefully the peritoneum (N) round the ring from the muſcles, ſhowing how it forms a ſac incloſing the hernia: then we ſhow the ſpermatic chord going down quite on the

outſide and behind this ſac, and lay open the vaginal coat of the teſticle, ſhowing that the teſticle lies diſtinct in its appropriated coats: and laſtly, ſhow the hernial ſac diſtinct from the ſpermatic chord or coats of the teſticle.

Appearances of incarcerated hernia.—In a ſtrangulated hernia, where it has been the immediate cauſe of death, though the eſſential circumſtances of the anatomy remain the ſame, the occaſional occurrences are infinitely varied. Upon making an inciſion to lay bare the ſac, it is found tenſe and firm, crowded with veſſels, and thickened towards the ring; the marks of inflammation are greater: perhaps externally there appears the cauſe of ſtrangulation in the inflammation of the ſurrounding membrane, and diſeaſe and ſuppuration of ſome of the lymphatic glands. But in the more recent and ſmaller herniæ, as thoſe more frequent under Poupart's ligament in women, the danger is greater and more preſſing. In ſuch caſes, in the ſtage of the diſſection which we are now conſidering, the inflammation is extenſive; the cellular membrane is caked and hard. In the femoral hernia we have to diſſect and expoſe the faſcia of the thigh; the coat of fibres which ſurround the proper peritoneal ſac of the hernia; and chiefly, to ſhow its relation to the ring, the ſpermatic chord and epigaſtric artery (See the outline, Plate I. fig. 2. and Plate XIV. fig. 1. and 2.).

But to return to the inguinal hernia. Upon opening the belly, the inteſtines are found inflamed and diſtended. If the hernia has been large, the myſentry is elongated by the pulling of the inteſtines, and the viſcera in much diſorder, even the ſtomach having deſcended from its place; ſo that ſometimes in old herniæ the abdomen is left almoſt empty of the floating viſcera. In a caſe where the inteſtines have been reduced either by the operation or taxis, the reduced portions are found lying within the ring adhering; often ſphacelated. Upon laying open the ſac of the hernia (if of old ſtanding), it is found to conſiſt of many layers, ſmooth as the abdominal peritoneum within, including moſt commonly the omentum, or a portion of the ilion in the ſac. If the omentum have fallen down, it will have altered much of its nature, become firm and condenſed, compoſed of hard pelicles of fat irregularly connected by membranes; with frequent ſtrings of adheſion, tortuous dilated veins, and general inflammation. If the ſtrangulation of the gut have advanced far, then it is dark and mortified, with foul ſerum in the ſac: adheſions are frequent betwixt the doublings of the gut, very rare between the gut and ſac. It would appear to me that the irregularity of the functions of the inteſtinal canal, the inflation or conjeſtion in the protruded portion of gut, is the more frequent cauſe of ſtrangulation, and of the worſt ſymptoms, in old hernia; and that the inflammation and conſtriction of the neck of the ſac is ſecondary merely. Sure I am, that the inteſtine is ſeldom reduced by the mechanical exertion; but merely the flatus in the inteſtine is forced into the inteſtines within the belly, and then the portion which had deſcended is drawn in by the action of the inteſtinal canal: and, again, it would appear, that frequently in attempting the reduction, the mouth of the ſac is puſhed aſide from the ring, and the reduction prevented.

EXPLANATION OF PLATE XII. Fig. 4. Showing the state of the ring in hernia.

This figure fully illuſtrates the more important points in this piece of morbid anatomy.

A, The scrotum of the left ſide laid open.

B, The penis.

C, Vena ipsius penis.

D, Maſs of fat upon the pubis, which reſtrains the erection of the penis.

E, Inguinal glands and fat.

F, Tendon of the external oblique muſcle.

G, The inſertion of the two pillars of the ring into the os pubis.

H, Marks the fibres of the TENDON running in diverging circles, as if carried down by the protruſion of the ſac.

I, The SAC laid open to ſhow the gut.

K, The bottom of the ſac.

L, The TESTICLE conſiderably diminiſhed.

M, The GUT ſeen within the belly.

N, The PERITONEUM held out by a thread, having been diſſected from the abdominal muſcles.

O, The PORTION of the GUT included in the hernia.

N. B. The relative ſituation of the parts in the femoral hernia will be fully illuſtrated in treating of the veſſels of the thigh.

OF HYDROCELE.—As in the laſt ſpecies of hernia the inteſtines take a new rout, and are preceded by a diſtinct ſac of the peritoneum; ſo in hydrocele, the tunica vaginalis teſtis being diſtended with fluid, the original ſheath (Q, fig. 3.) is not again opened, but that part which envelopes the chord (now degenerated into looſe irregular cellular membrane) remains entire, while the diſtended ſac ſwells on all ſides, but chiefly upwards, and before the ſpermatic veſſels conically. So that, upon laying open the ſac in the operation for the radical cure, the teſticle is ſeen covered only by its proper tunica albuginea, unleſs when, by frequent tapping, a partial inflammation has been communicated to the teſticle; in which caſe, it very commonly adheres to the fore-part of the tunica vaginalis which had been punctured with the trocar. To demonſtrate the anatomy of the advanced hydrocele, we inject the ſpermatic veſſels, follow down the chord behind the ſac formed by the dilated vaginal coat, fill the ſac, by a ſmall puncture, with ſpirits, and harden the whole in ſpirits for a few days;—then opening the vaginal coat, to ſhow the ſituation of the teſticle, the preparation is preſerved in ſpirits.

The diſeaſes of the ſpermatic chord ſhow us how completely it is changed in its nature from that of the peritoneum; for its cellular ſtructure ſometimes becomes the ſeat of dropſical ſwelling, forming a ſpecies of hydrocele:—ſometimes it appears like a collection of hydatids, yet neither communicating with the vaginal coat of the teſticle nor with the cavity of the abdomen:—ſometimes the hydrocele conſiſts of only one or two veſicles; and when the lower portion of the chord is preſſed, the ſwelling ſubſides, and retires to the cells in the chord within the abdomen. Knowing how peculiarly liable ſuch a congeries of veins as that which forms the ſpermatic chord is to diſeaſe, we cannot wonder to find the tortuous veins of the teſticle ſo ſubject to varicoſe enlargement and all its conſequences.

OF THE INVESTIGATION OF DISEASE IN THE PELVIS, AND OF THE MORBID STATE OF THE PARTS.

In their diſeaſed ſtate, the parts in the pelvis ſhould not be cut out haſtily, or before attention be paid to ſuch points as can alone be illuſtrated by an examination of the parts in ſitu. After the great operations, the ſpreading of inflammation to the bowels, the ſtage to which the inflammation has proceeded, the quantity of matter, and the courſe of ſinuſes near the wound, ſhould be obſerved:—then the parts being carefully waſhed, and the veſſels perhaps injected (if the ſtate of the ſubject will allow it, and if they be of conſequence in the diſſection, as after lithotomy), a freer inveſtigation may be allowed.

After puncturing the bladder, or after a tedious caſe perhaps of retention of urine where the catheter has been uſed, the inſtruments ſhould be allowed to remain: Then the bladder being opened from above, we can obſerve their true place, ſee them projecting into its cavity, judge of their effects, and of the inflammation in conſequence, and of their preſſure and effects on the neighbouring parts or oppoſite

coats of the bladder. In taking out the parts, the penis ſhould be firſt ſeparated from the pubes (which, by the bye, may be done without leaving any apparent deficiency, by leaving the ſkin and glans), the crura cut from the bone, and the whole forced down under the arch of the os pubis: Then proceeding to the inſide, cut all freely out, by carrying the knife cloſe to the bones of the pelvis; by which all the parts are retained for further inveſtigation in their natural connections.

How much more important does it make a preparation, to ſee the kidney diſeaſed, ſtones impacted in its ſubſtance, or abſceſſes excavating it, the dilated tortuous ureters, the contracted and thickened bladder with the ſtone in its cavity, or the diſeaſed proſtate gland, and conſtricted urethra, all connected and illuſtrating each other,—than if each of theſe were detached and in ſeparate glaſſes? If ſtudents would learn to value a muſeum, not by the numbers of the glaſſes and magnitude of the collection, but by the elegance, cleanlineſs, and uſeful inferences to be drawn from preparations of morbid parts, or the important points in anatomy which are illuſtrated by the others, teachers would become aſhamed of their opportunities thrown away, and merit would attach to thoſe who had made the beſt uſe of their ſituation, however narrowed their ſphere.

MORBID STATE OF THE PARTS.

Of the bladder.—Although in the great dilatation of the bladder from retention of urine, there is, in general, no apparent change in the coats; yet, in ſome inſtances, the inner membrane has been found loaded and black with extravaſated blood. Where rupture has taken place, the gangrene is of ſmall extent, and circumſcribed. In caſes of ſtone, cancer, and tumors, in the bladder, it is generally thickened (probably by continued irritation), and the inner membrane, if not evidently inflamed, is covered with an adheſive ſlimy matter. In ſuch as die violent deaths, and in ſome fevers, the bladder is ſaid to be found in a ſtate of very ſtrong contraction.

The moſt common effect of diſeaſe, as of a ſtone, ulcer, or fungous excreſcence, in the bladder, is the thickening of the coats, ſometimes even to half an inch in thickneſs. But this, if we examine narrowly, cannot be miſtaken for an increaſe of muſcular force, in order to overcome the difficulty of expelling the urine. The bladder, in this ſtate, becomes thickened, but at the ſame time inert. It gives great reſiſtance to diſtention, but its contraction is alſo limited: The urine is expelled frequently, and in ſmall quantity, but never completely evacuated.

The inner ſurface of the bladder is, in ſome caſes, diſeaſed with fungous or polypus excreſcences; ſometimes there are ſmall irregular tubercles upon its whole inſide; and not uncommonly ſuch tumors acquire a cartilaginous hardneſs, which, during the life of the patient, is with difficulty diſtinguiſhed from a ſtone. Even in ſome rare caſes, ſtones have, I believe, been formed in thoſe tumors; though a more frequent, but ſtill a very rare occurrence, is, that the ſtone, lying encyſted betwixt ſome of the ſtronger faſciculi of fibres, they contract round the ſtone while it has fallen into the interſtice, and holds it immoveable.

The prostate gland may be found ſwelled or obſtructed by caſual inflammation, or being enlarged, abſceſſes frequently pervade it. But theſe, it is remarked, do not ſo often attack the ſubſtance of the gland, as the cellular membrane ſurrounding or connecting its lobes. The gland itſelf does not eaſily ſuppurate.

In enlargements of this gland the conſtricting fibres upon the mouth of the bladder have a ſtrange effect in moulding the gland, as it gradually enlarges ſo as to protrude it backwards into the cavity of the bladder; which ſometimes increaſes ſo much (as all tumors do having once got a direction), that it forms a pendulous valvular excreſcence from the neck of the bladder, preventing the diſcharge of urine.

The enlargement of this gland may ſometimes not improperly be called a varicoſe enlargement; becauſe

the enlargement is not ſo much of its ſubſtance as of the ſurrounding parts and circle of veins, which are in ſituation and diſeaſes ſomewhat analagous to the hæmorrhoidal veſſels. I have ſeen in the neck of the female bladder as great an enlargement as in the male: And in many caſes, in diſſecting diſeaſed parts to give a clear and diſtinct view, the tumor gradually vaniſhes; and before we are aware, no mark of diſeaſe remains. But of this there is no danger in the moſt frequent kind of diſeaſe, the moſt incurable and diſtreſſing malady, the ſchirrhous enlargement, in old men. Too frequently, in the laſt ſtage of life, diſeaſe, and the debility of old age, falls upon the urinary paſſages, cauſing an irritability in the bladder and ſwelling of the proſtate gland, and terminating life with excruciating agony.

Even when no mark of diſeaſe is apparent, yet upon cutting into the gland, ſmall chocolate-coloured ſtones like ſeeds are found filling up its ducts, or in little ſacs. I have ſeen this gland ſtuffed with them like the gizzard of a fowl.

THE VESICULÆ SEMINALES ſeem to be ſeldom the ſeat of diſeaſe, though, from their ſituation behind the proſtate gland, they muſt frequently be involved in the diſeaſed ſtate of the rectum and bladder. Something of their affections has been already mentioned.

Following the courſe of the urethra, we may obſerve, that the GLANDULÆ ROTUNDÆ, or COUPER'S GLANDS, are frequently the ſeat or origin of extenſive runnings of matter into the urethra, and of fiſtulæ in the perineum. It has been obſerved, that ſtrictures are more general about the bulbous part. They are white, hard, partial only, or of ſmall extent; and in gonorrhœa, it ſeems confirmed by thoſe who have had the beſt opportunity of examining the urethra in diſeaſe, that there is no ulceration; the LACUNÆ are found filled with matter, and the inflammation chiefly towards the extremity of the urethra. The LACUNÆ of the urethra bear no relation to the ſmallneſs of their glands; for they are ſometimes ſo large as to receive the point of the catheter, and prevent its introduction into the bladder: and this is the more apt to happen, ſince the mouths are directed forwards, and act like a valve againſt any thing going contrary to the ſtream of urine. The effect of theſe lacunæ, as I ſhould underſtand it, is admirable: They are ducts to the glands; but they are reſervoirs alſo, retaining their little ſtores to lubricate the canal during the paſſage of the urine. The increaſed diſcharge from theſe muſt frequently baffle the uſe of injections, as their form defends them, in a great meaſure, from the contact of the fluid.

To examine the VERUMONTANUM, and that portion of the urethra which is embraced by the proſtate gland, it muſt be ſlit open upon its upper part. The verumontanum is upon the under ſide of the urethra; a little eminence marks it, ſtretching forwards into the canal with an acute ridge. On the moſt prominent part of this caruncle the veſiculæ ſeminales open in two diſtinct orifices; but a probe or briſtle is with difficulty introduced, owing to the ſoftneſs of their membrane and the colapſing of their mouths. All around this the numerous orifices of the proſtate gland open into the urethra. The ſecretion of the proſtate gland is frequently vitiated, and alſo that peculiar to the veſiculæ ſeminales; the ducts muſt be peculiarly affected during the diſcharge of ſemen. Whether the verumontanum ſuffers a kind of erection or relaxation, it will be difficult to ſay; but it is evident, that tumors or ſtricture muſt eſſentially affect that diſcharge, and occaſion juſt alarm to the patient. Of this ſee above, page 71.

OF THE KIDNEY. The varieties in the form and diſtribution of the emulgent arteries and veins, and in the ureters and pelvis, and whole of the gland, are ſo frequent, that they can ſcarcely be conſidered as curioſities.

It is probable that coagulated blood, or partly concreted mucus, having been forced out from the ducts, may have given riſe to the idea of worms being ſometimes found in the kidney. There is no doubt, however, that ſuch concreted mucus or blood frequently form the nucleus of calculi in this gland; for the natural

mucous ſecretion, which continually exudes from the urinary paſſages, allowing no depoſition from the urine to take hold upon them, prevents the formation of calculi. The urine is at all times capable of forming ſuch calculi when a proper baſis or nucleus is afforded, though a greater diſpoſition, or lithic diatheſis, as it has been called, is a diſeaſe more connected with the whole ſyſtem. Urinary calculi may be thus the ſymptom of a more univerſal diſeaſe; or local only and caſually produced. The ſtrange accidents by which foreign matters are made to form the centre of calculi, are innumerable and almoſt unaccountable; pieces of leaden probes, bougies, catheters, balls, needles. This local and accidental form of the diſeaſe is certainly the moſt favourable.

Suppuration following inflammation of the kidney, will form at one time an immenſe depoſit of matter, converting its ſubſtance into a ſac of pus; at another, only partial abſceſſes. Such collections have ſometimes been evacuated by the ureters, cauſing in their courſe, before they got to the bladder, dangerous retention of urine; or it may happen that, by communicating with the colon, the matter may be evacuated by ſtool. It may ſpread amongſt the ſurrounding cellular ſubſtance, or it may even point outwardly to the loins. Such diſeaſed action in the kidney has gone ſo far, that its ſeat has been only marked by a more condenſed indurated cellular ſubſtance.

In chronic diſeaſe of this gland, the appearance, on diſſection, is very different. It acquires an enormous ſize; or it becomes ſoft; or degenerates into an aſſemblage of hydatids; or perhaps a ſteatomatous maſs.

We may be at once ſenſible why, upon inſpiration and expiration, or in going to ſtool, or in efforts to make urine, the pain of inflammation in the kidney becomes more violent, when we obſerve its ſituation upon the muſcles of the loins and upon the diaphragm, and how it muſt be affected by the play of the latter muſcle. We may underſtand likewiſe, how in inflammation or enlargement of the kidney, a ſtiffneſs and numbneſs is produced in conſequence of the contiguity of the anterior twigs of the lumbar nerves; which, running downwards, play upon the groin and fore-part of the thigh. In retention of urine from the obſtruction of the URETERS by ſtones, hydatids, or clots of blood, they are ſometimes ſo much dilated as to reſemble a ſmall gut; and they become, at the ſame time, tortuous, or are irregularly diſtended; and in their partial dilatations, their internal coat is ſtretched acroſs like a valve. Their coats, too, in all ſuch caſes, become thickened. Where there is obſtinate reſiſtance, even the pelvis and ducts of the kidney become enlarged like a ſecond bladder.

OF THE RECTUM.—The rectum being a very glandular part, largely ſupplied with veins, and expoſed to a variety of exciting cauſes, is very ſubject to diſeaſe; and peculiarly to ſchirrous thickening and contractions of its cavity. When ſuch derangement proceeds to cancerous ulceration, it makes an ugly maſs of diſſection. In the laſt ſtage of ſuch a caſe, it will be found that the bladder is drawn into diſeaſe; that the ſurrounding cellular ſubſtance is hard and ſchirrous, ſometimes reſembling tallow; and that purulent abſceſſes run through it, perhaps forming communications betwixt the gut and bladder; the coats of the bladder alſo are thick and hardened, ſometimes cartilaginous.

It ſhould have been obſerved, in ſpeaking of the Section of the Pelvis, that in the adult the rectum is dilated into a great bag or receptacle immediately above its ſtrong ſphincter fibres; and we ought to recollect how neceſſary it may be to examine the ſtate of this part in all operations in the perineum.

THE FOLLOWING REMARKS ARE APPLICABLE CHIEFLY TO THE FEMALE PELVIS.—In woman, the action of the tranſverſalis perinei, ſphincter ani, and levator ani muſcles, differ in no reſpect from thoſe of man. The vagina has its peculiar ſphincter; but more internally, it is embraced by the levator ani. Beſides theſe muſcles, the vagina is influenced by the inflation of blood, like the penis in the male; for it is of a ſpongy nature, and interwoven with numerous blood-veſſels; and a cavernous veſicular flexus ſurrounds the ure-

thra, and is ſpread out upon the ſides of the vagina. The ſtate of all theſe parts is influenced by the ſame excitement with the cavernous bodies of the penis. The diſorder and relaxation of theſe muſcular faſciculi are followed by the ſame conſequences as in man; and from the interlacements of the conſtricting muſcles of the bladder, vagina, and rectum, and the univerſal connection of the levator ani, the ſame ſympathies and deranged ſenſations take place in diſeaſe.

Women, it is allowed, are more ſubject to hæmorrhoids than men; more eſpecially ſuch as have born children. This probably originates from a greater irregularity and leſs ſenſibility in the inteſtinal canal; from the preſſure upon the hæmorrhoidal veins in pregnancy; and in ſome meaſure, perhaps, from the wideneſs of the bones, and the greater ſtrength of muſcles requiſite to guard the perineum, whoſe occaſional derangement will be more extenſively felt. As the action of the muſcular fibres of the rectum in producing this diſeaſe has been already mentioned, little remains but to mark its varieties. Though in children piles may be occaſionally produced, yet in that caſe they quickly retreat, or there is a ſlight inflammation, in conſequence of which they become hard and painful, but are never permanent. But in elderly people, with habitual coſtiveneſs and its attendant frequent teneſmus and gripes, the piles gradually increaſe, and the veins, having a tendency to become turgid and varicoſe, theſe tumors become habitual; conſiſting of enlarged veins covered with the thin ſkin of the margin of the anus; ſometimes they are ſituated within the orifice and hid. In a more advanced ſtage, or what perhaps may be conſidered as a different ſpecies of the diſeaſe, theſe veins open upon the ſurface of the tumors, and bleeding become periodical in their diſcharge, connected with plethora of the venous ſyſtem of the abdominal viſcera, and no longer a local diſeaſe.

It may be uſeful to recollect, of how much conſequence continued preſſure is in many diſeaſes of the rectum; for we find, that in many caſes tents introduced have made wonderful cures of what was underſtood to be ſchirrous thickening of the coats; and where, by the narrowing of the paſſage, the fæces were almoſt entirely obſtructed. In women of ſuſpicious character, we muſt recollect that the venereal diſeaſe is more apt to be communicated to the anus, and give riſe to ſymptoms which may be miſtaken for worſe diſeaſes.

It was already obſerved, how the neck of the bladder in the female ſometimes becomes diſeaſed, reſembling that ſo frequent in the male. In a caſe of this kind, the patient being examined by the vagina, it was ignorantly ſuppoſed to be a ſchirrus of the vagina, from the extreme pain upon examination and the feeling of a hard irregular ſurface, which was occaſioned by ſcybalæ in the rectum. This appears ſo unworthy of notice, that it ſhould not have been mentioned, had not the woman been frequently examined, and at ſome diſtance of time, and by gentlemen who ſhould not have been eaſily deceived. The ſchirrous ſtate of the vagina, however, is not a rare occurrence; but is more generally connected with the ſchirrous ſtate of the womb, and probably produced by the diſeaſe of the latter encroaching upon it.

Cancer of theſe parts forms a terrible diſeaſe: ſometimes opening communications with the bladder; ſometimes with the rectum, with irregular ragged ulceration, and attended with excruciating lancenating pains.

The effects of the venereal diſeaſe muſt frequently preſent themſelves in the diſſection of theſe parts. Inflammation producing adheſions, often callous contractions, and narrowing of the vagina from the cicatrix of old ulcers, recent ulceration and excoriations.

The relaxation of the vagina, attended with a degree of laxity in the neighbouring parts, and perhaps wideneſs of the bones of the pelvis, allows the UTERUS to glide down and hang upon its ligaments ſo as to prolong them gradually, till the os tincæ being inverted, the vagina appears externally, forming PROLAPSUS UTERI. Sometimes, by the ſame relaxation of the parts, the uterus falls backwards by the weight of the fundus, and the neck lies obliquely acroſs the pelvis, and perhaps preſſes upon the neck of the bladder. This, however, is properly a diſeaſe of the firſt months of pregnancy; which, if allowed to go on

unreduced, becomes a moſt alarming cauſe of retention of urine. The cure of this diſeaſe by peſſaries is a delicate matter; for by the continued preſſure upon the vagina, a hollow is gradually made; by the continued irritation pus is gradually formed, ulceration takes place, and the conſequence is a fiſtulous ſore perforating the vagina, the ſuppuration ſpreading amongſt the cellular membrane.

What one has ſeen perhaps by ſingular chance, he is nevertheleſs apt to conſider as the moſt natural or frequent occurrence. The rude exertion of manual operation, or the violent efforts of the child, are deſcribed as the moſt frequent cauſe of the rupture of the uterus. But in a caſe of this kind which I met with, where the child's arm projected into the belly amongſt the viſcera, the cauſe was on diſſection found to be very different; for the pelvis being extremely narrow, little more than an inch in width, the uterus, by the continued preſſure betwixt the brim of the pelvis and the child's head, had been deſtroyed in the courſe of a tedious labour. I do not recollect that the wiſe proviſion (if we may be allowed the expreſſion) of the diſtribution of the veſſels of the uterus is pointed out; but it is evident, that in the moſt natural labour, the ſupply of blood to the womb would be interrupted by the deſcent of the child's head, were there not another ſource than the hypogaſtric arteries, *viz.* the ſpermatic veſſels; betwixt all of which there are extenſive communications, the blood from any one of its four ſources getting eaſy acceſs to the whole body of the womb. The appearances on diſſection in the above inſtance will characteriſe ſimilar caſes. Much ſerum was poured out into the belly; floating lymph and ſlimy viſcid matter, ſcarcely fluid, ſurrounded the arm: and it evidently appeared, that if the patient could have ſurvived a few days, the arm would have been incloſed by the inflammation and conſequent aglutination of the ſurrounding viſcera. The ſmell in ſuch gangrened viſcera is very peculiar; it is quite unlike that where pus is formed, and ſcarcely to be borne.

The neck of the uterus is moſt frequently the ſeat of diſeaſe. When it is ſlit up, irregularities, or the rudiments of ſarcomatous tumors appear; which ſometimes enlarging, and becoming pendulous, fill the whole vagina, and appear at the external part. But theſe polypous tumors are not peculiar to this part, but common to the whole uterus. When theſe tumors appear externally, they may be miſtaken for the prolapſus of the womb: for this latter is not always a regular tumor with the projecting os tincæ diſtinctly to be recognized; but, on the contrary, it is frequently very irregular and diſtorted, the orifice of the womb turned aſide, the vagina firmly adhering. Even in diſſection, ſometimes it is impoſſible to unravel the adheſions; and it is only known to be a prolapſus of the womb from the change in the viſcera, and the ſinking downwards of the fundus uteri betwixt the rectum and bladder. During life, it is known by the ſtilicidium, or by the periodical diſcharge from the orifice of the womb. The prolapſus uteri is often preceded and occaſioned by a diſeaſed ſtate of the uterus itſelf; or it is likely that a dormant diſeaſe of this viſcus may be excited by the eſcape from preſſure, by the expoſure of a ſecreting ſurface to air, and the attrition to which the parts are liable; and a terrible ulcerated fungous maſs is formed, taking away all ſemblance of the original form of the parts.

As of ſome conſequence in the examination of theſe diſeaſes in the living body, it may be obſerved, that either when examining in ano or within the vagina, the tumors or diſeaſed parts may not come within the touch without changing the poſture of the patient, putting them in an erect poſture, or in that of going to ſtool, and cauſing them to make an effort; by theſe means only the uterus, or tumors, or polypi, can be brought downwards within the reach.

Of all the parts of the female pelvis, the ovaria are the moſt frequently diſeaſed; though, in reference to practice, the knowledge of them is unimportant, if we except that of dropſy, ſo frequently occurring.

Their changes can ſcarcely be conſidered as diſeaſe: they ſhrink and become diminiſhed in ſize in old age; they become ſolid; they become more diſtinctly veſicular and enlarged, and full of a yellow turbid fluid; they become a congeries of ſmall hydatids:—Theſe diſeaſes advancing, they become ſchirrous and enlarged, firm, containing a ſteatomatous cheeſy matter, or diſtinct ſacs of fluid. In conſequence of diſ-

eaſe following impregnation (an imperfect impregnation is very improbable), we find fatty and ſtrangely condenſed matter; or, in ſome rare inſtances, hair matted and condenſed, and even teeth growing and fixed as in a ſocket, and with a completely formed enamel, as if the pulp and membranes of the teeth had been engrafted, and taken a communication of veſſels from the ovum, then grown to full maturity. In the dropſy of the ovaria, they ſometimes ſwell to immenſe ſize, filling the whole belly. The encyſted dropſy of the ovarium, when it has proceeded thus far, can only be diſtinguiſhed by the hiſtory of the caſe. The ſwelling is in the beginning diſtinct, inſulated, and moveable, and ſituated to one ſide, anſwering to the ſeat of the ovarium. It gradually dilates till it comes in contact with the peritoneum of the abdominal muſcles, adheres to it, ſtretches up to the diaphragm, forms adheſions with its lower ſurface, and throws back and compreſſes the inteſtines without adhering to them.

To give a full and comprehenſive view of the diſeaſes incident to the female pelvis would lead to a very long diſcuſſion. It would comprehend appearances infinitely varied, eſpecially in the impregnated ſtate. The diſeaſes of the uterus, placenta, and chord; of the ovum in all its ſtages, and particularly the abortion of the firſt months, with their multiplicity of deranged appearances, are difficult to be underſtood; and the explanation of them requires a complete knowledge of a very delicate and minute piece of anatomy, together with much practical dexterity. Though I have had ſeveral opportunities of examining the pregnant uterus, and have ſeen ſeveral curious inſtances of diſeaſe; yet all that I have had experience of would make but a few inſulated facts, of little weight in the importance of the ſubject.

In treating of the morbid anatomy, I have endeavoured to avoid the appearance of attention to minutiæ where nothing is underſtood, or where I could give no information; ſenſible that ſuch an attempt fills the eye only, and becomes a mere catalogue of diſeaſes. But I have attempted to place this part of my ſubject upon the wider baſis of the mechanical action of the parts or general conſequences, extenſively applicable, as depending upon the laws of the economy. Some obſervations on the peculiar action of the arteries in glands, as depending upon their form, I ſhould have wiſhed to have added; but as every principle in phyſiology, if eſtabliſhed, affects every part, however different in ſtructure, I ſhall throw theſe obſervations together in that part of this Work which treats of the Brain.

ERRATUM.

Page 73, *for* INTERSUSCEPTIO, *read* INTUS-SUSCEPTIO.

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A

SYSTEM

OF

DISSECTIONS.

PART IV.

CONTAINING

DISSECTION OF THE FASCIA AND SUPERFICIAL PARTS ON THE FORE PART OF THE THIGH;

DISEASES OF THE CUTANEOUS VEINS, LYMPHATICS, AND FASCIA;

OF THE LIGAMENT OF THE THIGH AND FEMORAL ARTERY IN THE GROIN;

TUMORS IN THE GROIN;

FURTHER DISSECTION OF THE ARTERIES AND NERVES OF THE THIGH;

ACCIDENTS AND DISEASES OF THE ARTERIES OF THE THIGH;

OF THE POPLITEAL ANEURISM;

OF THE CHANGES WHICH TAKE PLACE IN THE CAPACITY AND ACTION OF ARTERIES; AND OF THE CIRCUMSTANCES WHICH INFLUENCE THOSE CHANGES.

WITH PLATES.

BY CHARLES BELL.

EDINBURGH:

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A

SYSTEM

OF

DISSECTIONS.

DISSECTIONS OF THE THIGH.

Remarks introductory to the Diſſection of the Extremities; the Effects of the Muſcles and Faſcia upon the Veſſels; and the Peculiarities in the Diſtribution of the Veins and Arteries.

IN the diſſection of the thigh, the method of inveſtigation, as well as the object of it, is eſſentially different from that which is followed in the diſſections of the belly and thorax. We find the limbs made up of a ſolid muſcular fleſh, which ſurrounds the bones, gives ſymmetry and action to the limbs, and poiſes the trunk upon them: and, beſides the integuments common to every part of the body, we find them covered with ſtrong faſcia or the aponeurotic extenſion of prolonged tendons; which not only ſupports and braces the muſcles in their action, but gives the limbs a defenſive ſtrength, by forming them into a firm concentrated pillar.

The fibres of the faſcia, too, mingling with the common cellular membrane, dive amongſt the deeper muſcles, and divide and claſs them into faſciculi, having ſimilar powers and ſimultaneous action. We find the arteries branching amongſt the muſcles, and expoſed, we might at firſt ſuppoſe, to be interrupted in their actions amongſt thoſe active and contractile parts; but theſe arteries have energy and force to overcome or reſiſt the contraction of the muſcles of the limbs. The more languid flow of blood in the veins is indeed left expoſed to caſual interruption by compreſſion of the muſcles; but this preſſure upon the veins is counteracted, or its bad effects avoided, by their peculiar diſtribution. In the legs and arms, and in the neck and all fleſhy parts, there are two ſets of veins: the venæ comites, accompanying the arteries through their whole courſe amongſt the muſcles; and the cutaneous veins, which, though like the others they receive the returning blood from the arteries, take a different courſe to the heart, emerge from the oppreſſion of the muſcles, and return their blood by a ſuperficial diſtribution to the heart. We obſerve no ſuch variety of diſtribution in the cheſt or belly—no valves to counteract the retrograde impulſe of the blood; becauſe in theſe cavities there is no occaſional and partial action of parts by which the return of the blood can be retarded, the preſſure being uniform through the whole cavity—and becauſe, from this uniform preſſure, no diſtribution of the veins could free them.

When any preſſure is made upon the upper part of the thigh, if the pregnant uterus, for example, ſhould preſs upon the veſſels of the pelvis, or a ſchirrous tumor ſhould ariſe from the glands of the groin ſurrounding the crural veſſels, the veins are the firſt to ſuffer; the ſupply of blood is not diminiſhed, but the free return

of the blood is retarded, cauſing œdema: and in the caſe of an adventitious tumor, though both arteries and veins paſs through it, the arteries, by the ſtrength of their pulſation, remain free, and poſſeſſed of full room for action, however large the tumor; while the veins, being more paſſive, having no action, are encroached upon by the tumor, and compreſſed, and the blood made to ſtagnate in their dilated extremities.

We learn from this the importance of making the preſſure uniform over all the lower part of the limb, when we apply bandages or compreſs an artery. Were it poſſible ſo uniformly to compreſs a limb, from the toes to the top of the thigh, as to leave no part unincluded or unſupported (unleſs in inflammation of the parts), almoſt any degree of compreſſion might be uſed; for in that caſe the blood would flow uniformly over the whole limb; and though ſtifled in a degree, no part would be overloaded with blood.

Further peculiarities in the anatomy of the extremities will naturally come to be noticed in the courſe of the hiſtory of each diſſection.

FIRST DISSECTION OF THE THIGH.

Of the Faſcia of the Thigh, the Inguinal Glands and Superficial Veſſels, the Lymphatics and Cutaneous Nerves.

In acquiring a knowledge of the economy of the body, of the peculiarities in the diſtribution of the veſſels of the extremities, of the uſe and effect of the faſcia, and of the characteriſtic difference betwixt the limbs and the cavities of the trunk and head, this forms an important diſſection. With a view to ſurgery, it is no leſs important; ſince a knowledge of the points of anatomy which it includes is extenſively applicable to practice. It is almoſt impoſſible, by deſcription alone, to give ſuch an idea of the apppearance of the veſſels and membranes, as to enable any one readily to diſtinguiſh them in the diſſection; yet much aſſiſtance may be given, and the character of the parts may be ſo pointed out, that when once ſeen, the recollection will not be quickly effaced.

PRECAUTIONS NECESSARY IN CONDUCTING THE DISSECTION.

In laying open the integuments of the FORE PART of the THIGH, we ſhould not cut too deep, nor look for the ſmooth and ſtrong faſcia which, from deſcription, we may naturally have been led to expect; for upon the fore part, and above the tract of the important veſſels, the faſcia is of a looſe and cellular texture; and the gradual change which it undergoes is to be obſerved only by tracing it from its ſtronger expanſion on the outer part of the thigh.

The true ſkin only ſhould be diſſected back, leaving much of the ſubjacent cellular membrane. The parts which then come into view may here, as a general inſtance, be marked.

The LYMPHATIC VESSELS are immediately under the true ſkin. They are more ſuperficial than the veins and nerves. They run in ſtraight lines, are only partially ſeen, or are frequently abruptly broken off by the intervening pellicles of fat. They are very large and varicoſe in appearance, when diſtended, in the courſe of the ſaphena vein; more numerous upon the middle part of the thigh, and more thinly ſcattered, but more diſtinctly ſeen upon the outer part. In colour and appearance, when in their natural ſtate and collapſed, they reſemble looſe muſcular fibres; being flat reddiſh lines, moſt diſtinctly and ſtrongly muſcular in their colour, and pellucid only when diſtended with air. When theſe veſſels are

ſnipped obliquely with the ſciſſars, or punctured with the lancet and blown up, or injected with mercury, they take a very peculiar appearance; for they ſwell only betwixt their valves, whilſt the valves ſeem to cut them into beads irregularly joined. But the drawing will be more ſatisfactory than any deſcription.

Lymphatic glands.—At the groin, immediately under the ſkin, on a level with the lymphatics, and above the faſcia and cutaneous veins, we find the congeries of lymphatic glands. But all the inguinal glands are not thus ſuperficial; on the contrary, many are ſunk amongſt the condenſed cellular membrane, which, mingled with the aponeurotic membranes, forms a bed covering the femoral artery and vein.

Veins.—The ſaphena vein, we are told, lies above the faſcia; the great femoral vein below it. This is true; but it muſt at the ſame time be underſtood with ſome limitation. About ſix inches from the groin (if merely the ſkin have been diſſected back) we can only ſee the ſaphena vein ſhining faintly thro' the faſcia, even in the leaneſt ſubject. It comes up upon the inſide of the knee and thigh, and does not dive ſudddenly under the faſcia, but is gradually enveloped, and more firmly embraced, by the fibres of the faſcia; which at the fore part of the thigh is ſplit into layers, and ſo filled with the adipoſe membrane and fat, that it might be more juſtly eſtimated as condenſed cellular membrane. Farther down upon the thigh, again, on the inſide of the vaſtus internus muſcle, the more natural connection of this vein is with the cellular membrane, being immediately attached to the ſkin, and having no kind of protection.

Nerves.—Above the faſcia of the thigh ſeveral delicate and extenſively prolonged nerves are ſeen.

1ſt, Upon the inner and upper part of the thigh, branching to the ſcrotum, teſticle, and pubes, is the inguinal nerve, conſiſting of delicate twigs, which come by a circuitous courſe, and are derived by very delicate twigs from the firſt and ſecond lumbar nerve. Within the belly it may be ſeen coming out betwixt the pſoas and iliacus internus muſcles: it winds round part of the ſpine of the os ilium and inſide of the ligament, and pierces the ligament, and appears upon the pubes.

2dly, The internal cutaneous nerve comes out from Paupart's ligament above the crural veſſels, and is largely diſtributed upon the inſide of the thigh, extending its branches round upon the internal condyle of the os femoris and patella. It is a branch of the anterior crural nerve.

3dly, The middle cutaneous nerve*, from the ſame ſource with the laſt, comes out from the point marked by the ſartorius muſcle, croſſing the head of the rectus muſcle. It is diſtributed upon the fore and middle part of the thigh.

4thly, The external cutaneous nerve, derived from the third lumbar nerve, appears upon the outſide of the thigh, a little below the lower ſpinous proceſs of the os ilium; and dividing into branches, one runs round the back and outer part of the thigh, and the other runs down the faſcia, where it covers the vaſtus externus and outſide of the rectus muſcles.

Theſe veſſels and nerves have been mentioned before deſcribing the faſcia more particularly; as we muſt be aware of them in the firſt cut of the knife, or they are loſt to us for ever.

Were the thigh to be diſſected, in order to ſhew the faſcia only, I ſhould recommend it to be done firſt, by laying the faſcia bare upon the outer ſide, where it is ſtrong, and ſmooth, and tendinous, and where the ſtudent can form a confirmed idea of its nature; and then, by diſſecting it carefully inwards to the more ſoft and delicate fore part of the thigh, where the faſcia is with difficulty diſtinguiſhed from the common cellular membrane: I would even leave it there, and begin again to take the ſkin off from the inſide of the thigh, where, although the faſcia is not nearly ſo ſtrong or well defended as on the outſide, it is yet

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* Some very minute nerves from the deeper branches of the anterior crural nerve join thoſe; but they may be overlooked in the general arrangement.

more ſo than in the middle part above the great veſſels; and commencing anew from Paupart's ligament, I would diſſect downwards over the inguinal glands and veſſels. When a knowledge of the parts, and of their appearance, is once thoroughly obtained, it is no longer of conſequence how we proceed; but in a firſt diſſection, we are apt to lift membranes, which, being diſſected up from within outwards, the whole faſcia will inadvertently be diſſected off.

EXPLANATION OF PLATE XIII.

In the ſubject from which this was drawn the parts were lean and extenuated, without any full outline or maſs of muſcular fleſh: and, in order to ſhow the parts for which this figure is intended, the nerves, cutaneous blood veſſels, and lymphatics, ſuch a ſtate of the ſubject is required.

A, The TENDON of the EXTERNAL OBLIQUE muſcle of the abdomen. The manner in which it is tied down by the faſcia (C), and the way in which it forms the ligament of the thigh, and is inſerted into the os pubis (D), may be obſerved here.

B, The UPPER SPINOUS PROCESS of the OS ILIUM.

C, Tendinous fibres, communicating betwixt the tendon of the abdominal muſcles and the faſcia lata.

D, The OS PUBIS, cut very near its ſymphiſis.

E E, CELLULAR MEMBRANE, which, mingling with the faſcia in ſome ſubjects, almoſt totally obſcures its nature. In this web of cellular membrane, ſtretching over the great veſſels of the thigh, many lymphatic glands are ſituated F F F; and it is complicated with the cutaneous nerves, veins, and lymphatics.

G, Great origin of the FASCIA LATA of the thigh. At this place it includes in its duplicature the FASCIALIS MUSCLE; which, taking origin from the upper ſpinous proceſs of the os ilium, ſpreads down the thigh betwixt the plates of the faſcia. The FASCIA, in the direction of the muſcle, goes down the outſide of the thigh, very ſtrong; and, like a broad tendon, is inſerted into the external condyle of the thigh bone.

H, The FASCIA upon the inſide of the thigh, where it covers the gracilis muſcle. Here it is much thinner, but not ſo lax as in the middle part of the thigh and in the tract of the great veſſels.

I, The origin of the GRACILIS MUSCLE from the os pubis.

K, The VASTUS EXTERNUS MUSCLE.

L, The VASTUS INTERNUS MUSCLE.

M, The RECTUS MUSCLE. Theſe three great muſcles are ſeen ſhining of a darker colour through the faſcia, while the interſtices of theſe muſcles are marked by a lighter and more fatty line, like the linea alba and ſemilunaris of the abdominal muſcles. And here, as in the belly, the faſcia takes a firmer hold of the cellular membrane below, and ſends down fibres betwixt the muſcles.

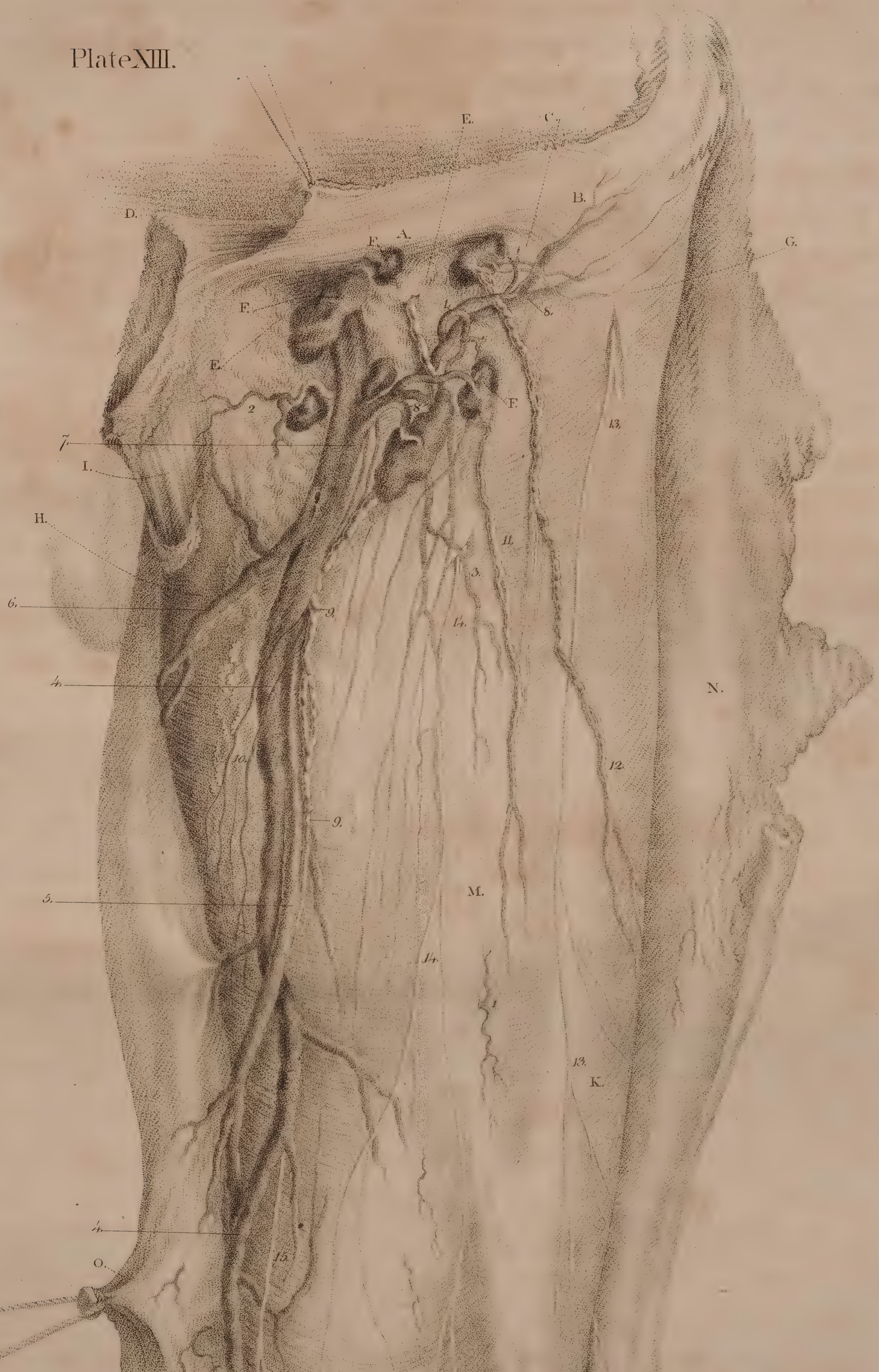
N, The INTEGUMENTS diſſected back from the outſide of the thigh.

O, The INTEGUMENTS which cover the inſide of the thigh held out, ſhewing the cutaneous branches of the vena ſaphena.

NERVES AND VESSELS.

1. A ſuperficial branch of the femoral artery, ſupplying the glands, fat, and ſkin of the groin.
2. A branch of the ARTERIA PUDICA EXTERNA going to the genitals.
3. A third cutaneous branch, ſupplying the integuments upon the fore part of the thigh.
4. The VENA SAPHENA in its courſe on the inſide of the thigh; where it is very ſuperficial, lying betwixt the ſkin and faſcia, and involved in the intermediate cellular membrane.
5. A very conſiderable branch joining the ſaphena vein. Theſe are ſeen a little twiſted by the pulling of the ſkin.
6. Another cutaneous vein coming round from the inſide and upper part of the thigh.

Plate XIII.



Drawn by Charles Bell.

Engraved by John Stewart.

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7. The trunk of the SAPHENA VEIN, before it goes under the faſcia to join the great femoral vein. It has been already remarked, that this vein does not plunge ſuddenly under the faſcia, as generally deſcribed; but is gradually encompaſſed with firmer cellular membrane as it aſcends.
8. Branches of veins belonging to the inguinal glands.
9. One of the numerous lymphatics which accompany the ſaphena vein injected. It appears knotted, or irregularly jointed when inflated or injected.
10. Several of theſe lymphatics lying collapſed: they appear in general as obſcurely reddiſh lines, parallel and ſtraight in their courſe.
11. 12. Other lymphatics injected.
13. EXTERNAL CUTANEOUS NERVE.
14. MIDDLE CUTANEOUS NERVE.
15. INTERNAL CUTANEOUS NERVE.

OF THE SUPERFICIAL PARTS SEEN IN THE FIRST DISSECTION OF THE THIGH CONSIDERED AS SUBJECT TO DISEASE.

IT has been already explained, that, in treating of morbid anatomy, it is intended, not merely to include the diſeaſed ſtate of the viſcera, but alſo the derangement of the natural anatomy of the extremities and external parts, whether by violence or by diſeaſe, with the conſequences of their derangement to health and life. In the preſent review of the parts before us now, we have more to obſerve than might ſeem ſtrictly to belong to ſo limited a diſſection; as we ſhall conſider the diſeaſes of the cutaneous veins, and nerves, and faſcia in general.

INFLAMMATION AND DISEASES OF THE CUTANEOUS VEINS.—Although it might have been expected that the ingenious paper of Mr Hunter upon the inflammation of veins ſhould have excited general attention, and have been followed up by further obſervations, we do not find that any progreſs has been made in their pathology ſince that time. He pointed out the effect of inflammation upon veins; ſhewed, by diſſection, how it was propagated alongſt their cavities after amputation, bad compound fractures, and extenſive abſceſſes; proved that matter was ſometimes formed in them; and that, in general, the conſequence of the inflammation was to produce partial or interrupted adheſions of their inner coats, preventing the matter from paſſing into the tide of blood. At the ſame time, the poſſibility of matter thus formed mixing with the blood, and being driven to the heart, was explained. "I have ſeen (ſays he), from a wound in "the foot, the vena ſaphena inflamed all up the leg and thigh, nearly as high as the groin; and I have "been obliged to open a ſtring of abſceſſes almoſt through its whole length." In other inſtances, after ſimilar injuries, he found the inner ſurface of the veins furred over with coagulable lymph *. Theſe obſervations of Mr Hunter are given in illuſtration of the effects produced by accidents in blood-letting, and as eſtabliſhing a new principle upon which to explain the ſtrange ſeries of ſymptoms which ſometimes take place after bleeding. In this view we ſhall afterwards have occaſion to attend to theſe facts; but in the mean time we may proceed to the conſideration of other conſequences of the injuries of veins.

It has been already explained, how the preſſure of the uterus, or of an adventitious tumor in the pelvis or groin, may diſtend the veins of the leg merely by increaſing the reſiſtance to the circulation without any diſeaſe or failure in the energy of the coat of the veins. In old people, again, ſuch diſtenſion has an evident connection with the general plethora of the venous ſyſtem, and in all probability with a failure of

* The inner coat of arteries has in ſome inſtances ſhewn a degree of inflammation, propagated in a retrograde courſe to the heart, as after the operation for aneuriſm.

that greater degree of reſiſtance which the veins of the lower extremities ſhould poſſeſs, and which is required in them to keep the balance of the ſyſtem, and counteract the preſſure of the column of blood.

But the dilatation of the cutaneous veins is not confined to ſuch caſes as theſe; for we find that in younger men the veins are often variouſly diſeaſed; that ſometimes they are varicoſe, not unfrequently degenerating into tumors, which, amaſſing the blood, affect the neighbouring parts, forming a dangerous diſeaſe. Sometimes, again, influenced by the contiguity of diſeaſe, they become tortuous and enlarged round the baſe of ſome tumors, or the margin of callous ulcers, forming in many inſtances their moſt characteriſtic feature.

Since we know that the natural capacity of the veins muſt depend upon the juſt mean of their reſiſtance to the action of the heart and arteries, we cannot be at a loſs to conceive how diſeaſe ſhould ſo weaken the elaſticity and power of reſiſtance of their coats as to allow them to dilate; and (as their dilatation is in length as well as in diameter) to become conſequently varicoſe and tortuous. To illuſtrate this, let us take the following outlines of a caſe: A young gentleman, eager in country amuſement, was, in ſcrambling amongſt bruſhwood, pricked with a thorn in the ſaphena vein, where it gathers its branches upon the inſide of the leg. He was not ſenſible of receiving the injury at the time; but upon returning home, the family obſerved blood running down his ſtocking; and upon examination, he found the prickle ſticking in the vein. He, of courſe, thought little of it; but it feſtered, and looked unkindly for ſome time. By and bye, a little tumor formed upon the part; and further up the limb, the veins in ſucceſſive ſtages became enlarged, with varicoſe circles of veins inſulated apparently at firſt, and forming diſtinct tumors in the courſe of the ſaphena and its branches. Can there be a doubt that in this caſe the varicoſe enlargement was a conſequence of the injury received, any more than that in other inſtances inflammation and ſuppuration are the effect of the injury received? We are accuſtomed to find contraction and thickening as the conſequences of inflammation: both of theſe took place here, and are not incompatible with partial dilatations. All varicoſe enlargements (and I regret never having had an opportunity of diſſecting the veins in ſuch a ſtate) are to the feeling irregularly hard. There is a deficiency felt at intervals; a pitting into which the finger ſeems to ſink, with hard incompreſſible edges. Theſe indurations are more probably formed by the indurated coats in the abrupt angles of the branches than by concreted blood.

A ſtate of the veins, not it is to be hoped ſtrictly analagous to the laſt caſe, but illuſtrated by it, ſometimes takes place without any apparent cauſe. Tumors will gradually ariſe from veins, which, upon diſſection, are found to contain only a confuſed maſs of coagulated blood and mucus, without diſtinction of bones, membranes, or muſcles. Such tumors will ſometimes ſeem to take their origin from the bones, being ſmall, inert, firm tumors, at firſt; but, by ſlow progreſſion, aſſiſted perhaps by the means uſed to bring them to ſuppuration, increaſing till, upon a raſh attempt to extirpate them, it will be found that they are interſected with lamellæ of bone, and that it is abſolutely neceſſary, from the confuſion of diſeaſed parts, to finiſh the operation by the amputation of the limb.

We ſhould perhaps claſs with theſe laſt ſuch tumors as, appearing at birth hardly raiſed above the common integuments, gradually dilate as childhood advances, and form evidently varicoſe tumors, having an irregular knobular ſurface; and increaſing in the brightneſs of their hues, purples and red, bleed in their advanced ſtage, and require operation *. Such ſpongy tumors being allowed to increaſe too much, and take a firm ſeat upon the bones, will generally, though extirpated, regenerate. In the operation there is much bleeding; the tumor is, when cut into, like a honeycomb; and the arteries, as if emptying into theſe ſacs, ſend out their blood with great force. I have ſeen ſuch tumors on the head, under the chin,

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* The tumor "is of a ſublivid hue, unequal, internally ſpongy, and full of veſſels."—*Underwood.*

and on the belly; though they occur, I believe, more commonly on the ſpine in the back or neck. The general opinion ſeems to be, that they ariſe from injury done to the child by its preſſure in the womb.

But let me not be underſtood to ſay, that ſuch tumors are ſimply a congeries of varicoſe veins; for it is evident, that in theſe caſes, as in other more familiar examples, there is a local diſeaſe acting upon the neighbouring veins, and drawing them into diſeaſe, allied in its nature to proper cancer. Thus we ſhall find a tumor growing from ſome fleſhy part, hard and knobular, with diſtorted veins, with a fretting ſore upon its moſt prominent part, and bleeding, ſometimes an acknowledged cancer, yet differing in no very definite character from thoſe of which we have been ſpeaking.

Diseases of the lymphatics.—The ſuperficial lymphatics point out to us, in ſome inſtances, the nature of diſeaſe; for being extremely ſuſceptible of inflammation, they apprize us of infection, and lead us by a hard inflamed line to the neighbouring glands. This effect of local poiſon and inflammation on the abſorbent veſſels has been long obſerved, being one of the great proofs of the theory of abſorption. But more lately Dr Ferrier of Mancheſter has endeavoured to prove a more general affection of the lymphatics of the leg and thigh in thoſe ſwellings incident to women after childbirth. In the writings of that gentleman, we have much to admire; but in a mind inquiſitive and ingenious, there is a natural bent and facility of generaliſing facts and obſervations, perhaps immature or haſtily adopted. It will perhaps appear to an unbiaſſed mind, that the ſtate of the limb in theſe caſes is more of the nature of a critical ſwelling, than a merely local affection; and that the obſtruction and inflammation of the lymphatics of the limb may be more naturally explained, upon the idea that this inflammation is ſympathetic, and communicated from the extremities of the lymphatics to their trunks, than that the diſeaſe is primarily in the lymphatics, and that their affection is the cauſe of the ſwelling of the limb.

Dr Rutherford, whoſe converſation upon profeſſional ſubjects is ſo replete with information, has favoured me with another inſtance of diſeaſe in the lymphatics*. After violent and long continued exerciſe, where any part of a limb has been expoſed to continued friction (as the inſide of the leg or thigh after having been long on the ſaddle), the lymphatics are liable to inflame, when a hard cord may be traced in their courſe alongſt the limb to the neighbouring glands. This takes place without any leſion of the cuticle or the ſmalleſt ulceration; but it ſeems to be the mere effect of the continued friction of the coats of the veſſel which makes them become fretted and inflamed. In a caſe of a riding groom, which occurred in the Infirmary here, the inflamed lymphatics were ſo ſwelled and tender in their courſe upon the inſide of the thigh, and in the glands of the groin, that the man could not move without excruciating pain.

What the appearance of the lymphatics in ſuch great inflammations may be, we can only ſpeak of from analogy; for they have been little attended to in morbid diſſection: but when we conſider that their activity muſt be influenced by a ſtimulus propagated from their abſorbing mouths to the trunks of the ſyſtem, we have rather to wonder that inflammation and diſeaſe ſhould be ſo ſeldom excited in them. Accident ſhews what from theory we are led to conceive, viz. that the fluids in the lymphatics are accelerated by the action of the muſcles; for when in wounds a large lymphatic is laid open, and continues to diſcharge after the ſurface is healed, we may obſerve a guſh or acceleration of the diſcharge upon any exertion of the limb. This accident, from the puncturing of a lymphatic, muſt happen in every the moſt ſuperficial inciſion, but is not generally obſerved till the ſore is healing; when, from the tumefied extremity of the veſſel, the fluid is ſeen diſcharging as from the head of a pimple, and ſo abundantly as quickly to moiſten

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* If I have failed in paying the tribute due to the abilities of this gentleman, ſo much diſtinguiſhed for a perfect command of information, and for that aptneſs of illuſtration which a varied and comprehenſive knowledge can alone ſupply, it is not from a want of the full ſenſe of what is due to him, but becauſe praiſe carries too much the appearance of a conſciouſneſs that we are able to appreciate what we admire.

the dreſſings. Upon the continuance of this diſcharge, aſtringents are generally applied; but they ſometimes fail: and many caſes in collections ſhew, that the diſcharge continues obſtinate under theſe remedies. A caſe occurring under Dr Rutherford of a wound in the fore part of the leg with an adze, was very ſimply cured by preſſure below the wound in the tract of the lymphatic.

Of the fascia.—Every one is aware of the bad conſequence of tight bandaging in inflammation; and that where the parts are ſwelling under an unelaſtic bandage, the inflammation is increaſed, great pain is excited, and the member is very apt to fall into gangrene. Nearly the ſame conſequences, in a leſſer degree, are frequently to be looked for from the binding of the faſcia in deep ſeated inflammation. For the muſcular parts ſwelling as after penetrating wounds, and being confined by the ſtrong embraces of the faſcia, eſpecially in the thigh and fore arm, it cauſes excruciating pain, with contractions of the limb. The elaſtic feeling which this tenſion of the parts gives to the touch in the firſt ſtage of inflammation, conveys the ſenſation of matter beneath, which is a frequent miſtake. In abſceſs, the faſcia being of a more inert texture, not ſo readily partaking of inflammation and ſuppuration as the ſubjacent ſofter parts, confines the matter, and cauſes it to ſpread more extenſively amongſt the looſe cellular membrane.

It was long believed, that in punctured wounds the bad ſymptoms were owing to the extreme ſenſibility in the tendinous parts when wounded; but they are now more univerſally attributed to wounds of the cutaneous nerves; while another and diſtinct train of ſymptoms follow the ſwelling of the inflamed parts, while ſtrictly embraced by the faſcia. The faſcia itſelf, though inſenſible in its healthy ſtate, and ſlow to inflame, is yet difficult of reſolution when it does inflame, becoming thickened and contracted; the cure being only to be accompliſhed by a free inciſion. It is this which makes the knowledge of the faſcia ſo peculiarly neceſſary to the ſurgeon. If he be ignorant of the courſe and connections of this membrane, he will make many fruitleſs inciſions before he cuts the faſcia ſo effectually as to take off the tenſion from the limb.

OF THE LIGAMENT OF THE THIGH, AND ITS CONNECTION WITH THE ABDOMINAL RING.

Some perhaps may cenſure the frequent recurrence of the ſame ſubject; but if it be remembered, that the method of diſſecting, and the views we have of the parts, eſſentially affect our underſtanding of them; and that, to acquire a thorough knowledge of ſome of the moſt important points, we ſhall more readily ſucceed, by ſimplifying our purſuits, it will rather appear that to vary thus the object of our diſſection, according to the views which our previous enquiries ſuggeſt, will, in the end, enable us to form a juſter eſtimate than if our firſt efforts were bewildered by too great a latitude of enquiry.

It matters not whether the femoral ligament be conſidered as a diſtinct ligament, or as the tendon of the external muſcle of the belly; but the latter ſuppoſition makes the more ſimple explanation.

The flat tendon of the external oblique muſcle of the abdomen, after a careful diſſection, and when viewed from without, is ſeen (upon its lower part) ſending its fibres obliquely downwards to the os pubis; and when approaching that bone, ſplitting, in order to give exit to the ſpermatic chord. The tendinous fibres are ſeen croſſing again, after having formed the ring. It has been conceived, that this decuſſating of the fibres makes a proviſion againſt hernia; and that the violent actions of the abdominal muſcles, which muſt preſs upon the viſcera, have a tendency at the ſame time to draw together theſe decuſſating fibres, and prevent the inguinal hernia. But, by a ſtricter attention to the parts, it will appear, that their conſtruction is ſuch as to preclude the deſcent of the viſcera when there is no preternatural laxity or malconformation.

The ligament of the thigh is formed by the tendon of the external oblique muſcle of the abdomen taking a firm hold of the ſpinous proceſs of the os ilium, and ſtretching over the muſcles and arteries of the thigh to the os pubis. On the outer part, as it riſes from the os ilium, it is very firmly tied down by its connection with the faſcia of the thigh. In its whole length, but chiefly as it approaches the pubes, it is not the rounded tendon which, from viewing it on the outſide, we ſhould expect; but it is turned in and inſerted into the os pubis with a flat broad horizontal tendon. The conſequence of this is, that at the point towards which the viſcera muſt gravitate in the erect poſture of the body, it is very ſtrongly ſecured: and that the effort of the viſcera to protrude is not made under the arch or ligament, but above it; ſince the margin of the tendon ſpreads thus horizontally to be inſerted into the os pubis.

The ſpermatic chord lies as in a groove formed by the ligament as it approaches the os pubis; and as the extremity of the ligament forms the lower pillar of the ring, an exit is, by a peculiar yielding or twiſting of its more outward fibres, allowed for the chord, without diminiſhing the ſtrength of the femoral ligament, which, by its horizontal ſheath ſtretching backwards, is firmly inſerted into the bone. Thus the ſpermatic chord is not ſubjected to the compreſſion of the two pillars of the ring; for as the lower pillar of the ring is the extremity of the femoral ligament, as from its connection with the bones it is immoveable by the action of the abdominal muſcles, and as this lower pillar holds the chord in a kind of flat groove laid horizontally on the os pubis, its outward fibres only yielding to allow the chord to eſcape, the conſequence is, that the upper pillar (which ſpreads its fibres on the outſide of the lower) does not, when made tenſe by the abdominal muſcles, compreſs the chord againſt the lower one. On the other hand, the ſecurity of the abdominal ring depends upon the obliquity of the paſſage, and upon the preſſure of the viſcera not being made in the direction of the chord, but laterally.

DISSECTION OF THE FEMORAL ARTERY IN THE GROIN.

In proceeding to diſſect away from the groin the glands and fat (as ſeen in Plate XIII.), we ſhall find a few delicate ſuperficially diſtributed nerves coming from under the ligament of the thigh. We ſhall find alſo, that the cellular membrane which ſurrounds the great veſſels forms a condenſed bed, independently of an aponeuroſis upon the ſubjacent muſcles. The inner ſurface of this cellular membrane is ſtrong from the interlacing of fibres. It covers and inveſts the great artery and vein. The ſame condenſed cellular membrane is continued behind the vein and artery; and by pulling up theſe veſſels, after diſſecting it back from before them (as in Plate XIV. fig. 1.), their branches may be ſeen piercing it like the veſſels of the heart going out from the pericardium. All the veſſels in the body are more or leſs ſupported in this manner by ſheaths of cellular membrane; but it is at ſuch places as this in the groin that it becomes a great object in ſurgical anatomy. In bringing the parts into the ſtate preſented in Plate XIV. fig. 1. if the ſubject be in a favourable condition, very large lymphatic veſſels may be obſerved courſing obliquely over the great artery, and running parallel to its conſiderable branches.

EXPLANATION OF PLATE XIV. Fig. 1.

A, Paupart's ligament, formed by the external ſheet of tendon of the abdominal muſcles.

B, The cellular substance, filling up the angle in the groin above the iliacus internus, pſoas, and pectenalis muſcles.

C, The condensed cellular membrane, incloſing the femoral artery, diſſected back and held out by a hook. This ſheath conſiſts partly of the common adipoſe membrane, partly of the layers of the great femoral faſcia.

D, A ſolitary lymphatic gland left.

E, The os pubis.

F, The SPINE of the OS ILIUM.

G, The SARTORIUS MUSCLE.

H, The GRACILIS MUSCLE.

I, The firſt head of the TRICEPS muſcle, or ADDUCTOR LONGUS.

K, The third head of the TRICEPS, or ADDUCTOR MAGNUS.

ARTERIES AND VEINS.

1. The FEMORAL ARTERY at its moſt prominent part.

2. The GREAT FEMORAL VEIN, after being joined by the greater ſaphena vein.

3. The EPIGASTRIC ARTERY, emerging from the cellular membrane, and going up behind the tendon of the abdominal muſcles. Betwixt this artery and the point B is the ſeat of the femoral hernia.

4. A ſuperficial branch of the femoral artery, ſupplying ſeveral of the lymphatic glands, the cellular membrane, and upper part of the ſartorius muſcle.

5. Another ſuperficial branch, tending more inwardly to the integuments of the private parts, and called PUDENDA EXTERNA. (See next Plate.)

6. 6. The great diviſions of the ARTERIA PROFUNDA femoris, ſeen piercing the involving membrane.

7. 7. Muſcular branches, ſupplying the ſartorius.

8. Muſcular branches, ſupplying the triceps.

9. The ANTERIOR CRURAL NERVE. It is ſeen branching amongſt the muſcles, and following the arteries in their great diviſions.

10. Branches of the OBTURATOR NERVE, ſeen deep amongſt the adductor muſcles.

OF TUMORS IN THE GROIN.

UNDER this title it is not meant to give ſuch a hiſtory of the great varieties of tumors which occur in the groin as properly belongs to books of ſurgery; but merely to mark their moſt prominent diagnoſtic features, as illuſtrated by a knowledge of the anatomy. Theſe, when the parts are before us, make an impreſſive and important leſſon.

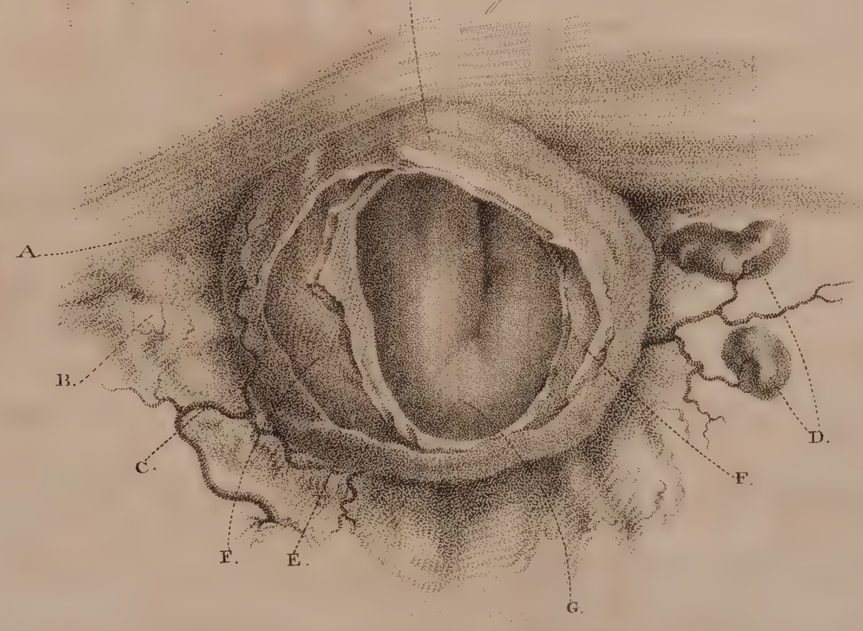
The diſeaſes which may be miſtaken and confounded are femoral or crural hernia with inguinal hernia; bubo with femoral hernia; common ſcrophulous abſceſſes of the inguinal glands with the lumbar abſceſs; and lumbar abſceſs with diſeaſe of the hip-joint.

It is not at every point under the ligament of the thigh that the femoral hernia is found to protrude; but only at that point where the ligament is leſs firmly tied down, where the cellular membrane is looſer, betwixt the femoral artery and vein and os pubis. This, it may be obſerved, is a ſmall outlet, ſtrictly embraced by the crural veſſels and epigaſtric artery on the outſide, and by the firm inſertion of the ligament into the os pubis on the other. It is immediately in the bend of the groin, and towards the inſide; ſo that it is very near the ſeat of the inguinal hernia. And when a femoral hernia in a male is ſmall, and comes down ſuddenly, and is attended with much inflammation, eſpecially if the patient be corpulent, having much fat upon the pubes, the tumor ſo ſpreads upwards, and becomes ſo tender, that it cannot be freely handled; and it is often a difficult matter to ſay preciſely whether it be a femoral or an inguinal hernia. In all the other inſtances of diſeaſe in this part, and in general in the femoral hernia, the ring and the ſpermatic chord remain free, ſo that no room is left for doubt. In the diſeaſes of the ſpermatic chord, hydrocele of the chord, or varicoſe enlargement of its veins, the abſence of the more urgent ſymptoms of ſtrangulation undeceives us, though the tumor ſhould reſemble hernia. But in the queſtion, Whether it be femoral or inguinal hernia, as the ſymptoms of ſtrangulation may originate from either, we are left to

Plate XIV.

Fig. 1.

Fig. 2.



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determine from the local appearance. The difficulty is, however, of no great importance, as our operation has only to be the more cautiouſly conducted in the firſt ſtage.

If a patient with a bubo or other GLANDULAR SWELLING, immediately in the ſeat of hernia; ſhould at the ſame time be attacked with ſymptoms reſembling thoſe of ſtrangulation, as vomiting or want of paſſage by ſtool (a caſe by no means unlikely), it may become extremely difficult to determine upon the caſe; notwithſtanding the lightneſs with which it is commonly mentioned. I have not ſeen a bubo miſtaken for a hernia; but what is more extraordinary, I have ſeen a hernia, and an inguinal hernia too, miſtaken for a bubo. The tumor extended down from the ring upon the groin; was ſmall and circumſcribed; and ſo violently inflamed, that it ſeemed upon the point of ſuppuration. But the moſt deceiving circumſtance was, that the patient was not reduced; he was ſtrong, and walked ſtoutly, inſomuch as to make his eſcape from the ſurgeons. It was naturally conceived, that if it had been a hernia ſo far advanced, the patient muſt have been more reduced, and every ſymptom of ſtrangulation more urgent. But the man died afterwards, and I ſaw the diſſection.

Herniary tumors are ſoft and elaſtic at firſt, and become firm and more incompreſſible upon the approach of ſtrangulation. Glandular tumors are in general very hard in their commencement, circumſcribed, and moveable; and before they have attained a ſize which can be miſtaken, become ſofter, more prominent, and diſcoloured: when matter is formed, it is ſufficiently evident. I ſuſpect, that in the caſe of hernia which I have mentioned above, the inflammation, which occurred ſo early, had been an eryſipelatous affection, occaſioned by the attempts to reduce the gut. It appeared dark, and like inflammation verging to ſuppuration.

The LUMBAR ABSCESS appears in the groin, commonly upon the outſide of the femoral artery, under the ſtronger part of the faſcia, and nearer the os ilium. When the tumor forms ſlowly and regularly, the faſcia can be plainly felt; and when it is far advanced, and the faſcia gives way, the deficiency is plainly felt with the tenſe edges of the faſcia. The lumbar abſceſs, however, does not always point thus regularly, but is more extenſively diffuſed in the groin, even ſurrounding and including the femoral veſſels; or it runs ſo deeply amongſt the muſcles, that the lancet or trochar cannot reach it with ſafety. In the dead body, upon laying open the abſceſs in the thigh, and freeing it of matter, a new diſcharge is ſeen to come from within the belly. Upon following this ſinus, it is found to run up behind the pſoas muſcle, upon the vertebræ of the loins, and down the os ſacrum; and theſe bones are generally carious. In ſome inſtances the abſceſs continues its courſe by the ſpine and ſide of the inteſtinum rectum, and points by the ſide of the anus.

The ſuppuration of the inguinal glands ſimply, where there is no communication with the internal parts, may be known by the hiſtory of the diſeaſe. A ſcrophulous diſeaſe of theſe glands will commence by thin induration and cluſtering, and advance ſlowly to ſuppuration. In general, though not always, the lumbar abſceſs will be marked by the greater tenſion and prominency in the erect poſture, in conſequence of the gravitation of the matter from the loins.

Collections in the hip-joint may protrude in ſuch a manner upon the groin, as to be miſtaken for abſceſs of the glands, or lumbar abſceſs. The affections of the joint are ſo peculiar, however, that they cannot be long miſunderſtood. Inflammation and diſeaſe of the joint is almoſt of neceſſity attended with an elongation of the thigh, by the filling up or diminution of the cavity of the acetabulum and elongation of the capſular ligament.

OF THE ANATOMY OF THE FEMORAL HERNIA.

THE frequent occurrence of the femoral hernia muſt impreſs us ſtill more forcibly with the importance of this piece of anatomy. Upon recollecting the natural ſtate of the parts, there will be no difficulty in diſtinguiſhing their relative ſituation.

In a recent hernia of the thigh, the tumor is in general ſmall. Very often during the life of the patient it is to be diſcovered only by the ſymptoms, not by the ſwelling in the groin; and theſe herniæ are the moſt dangerous and ſuddenly fatal.

If the rupture have been ſuddenly fatal, then proportionally there is leſs derangement of the natural anatomy; for it is little altered but by the effect of inflammation. The faſcia will be found tenſe and ſtretched over the tumor; the tumor is formed in a bed of inflamed cellular membrane; and the fibres of the faſcia, mingling with the condenſed cellular ſubſtance, need to be cut through before we arrive at the ſac which is formed by the peritoneum. If the thigh have been injected, and the tumor be conſiderable, we find the external pudic artery *, and inguinal cutaneous branches, ramifying upon the ſac, chiefly upon the ſide next the pubis.

A juſtly celebrated author has ſaid, that the femoral hernia is leſs apt to be ſtrangulated than the hernia of the ring: but it is evident, that the latter is comparatively leſs liable to occaſional derangement. For not only is the ſtrangulation of the ſpermatic chord prevented by the mechaniſm of the parts when in their natural ſtate, but even in hernia (eſpecially where it has continued for ſome time) the extenſion of the fibres of the external oblique, round the margin of the ring or neck of the ſac, is ſuch, that before the action of the abdominal muſcle can pull them, ſo as to compreſs the ſac, it is held in check by thoſe fibres, which continue in a direct line. Or, in other words, the paſſage through the tendon of the abdominal muſcle is not ſuch as we ſhould conceive from a rupture ſplitting the parallel fibres, and obtaining a paſſage liable to compreſſion, by the extenſion and conſequent approximation of thoſe fibres; but, on the contrary, the fibres are gradually elongated as the rupture protrudes and increaſes; thus forming a circular opening, extending outwards and downwards conically, ſo as not to be liable to compreſſion by the action of the muſcles. The parts about the ring, too, it may be obſerved, are not ſuch as to inflame ſo readily as thoſe in the arch of the thigh.

Under the ligament of the thigh, there being much vaſcular cellular membrane and glands, there muſt be produced great ſwelling and ſudden tenſion, upon inflammation being communicated to that part; while the occaſional action of the muſcles going out from the pelvis, with the tenſion of the faſcia, in the various poſtures of the body and actions of the limbs, muſt be a frequent exciting cauſe.

In operating for the femoral hernia, there are two points of the anatomy of much importance: Firſt, the knowledge of the membranes which inveſt the tumor, and which muſt be carefully attended to in the external inciſion: And, ſecondly, the danger which attends the ſecond ſtage of the operation in cutting the ligaments of the thigh, to free the gut from ſtricture.

EXPLANATION OF PLATE XIV. FIG. 2.

In illuſtration of the firſt object, the ſecond figure of the annexed Plate is given, in which there is an external view of the parts after a full diſſection.

A, The FEMORAL LIGAMENT, making the ſtricture upon the protruded parts. The hernia is in the uſual place, betwixt the femoral veſſels and the inſertion of the ligament into the os pubis.

B, CELLULAR MEMBRANE, lying upon the pectenalis muſcle. It is evident, even in this view of the parts, how ſtrictly the hernia is embraced by the ligament at A, and the cellular membrane B, upon the one ſide; and the crural veſſels and epigaſtric artery, and the ſtronger connections of the ligament with the faſcia lata, on the other. Even Pott ſpeaks as if we had all the ſpace betwixt the pubes and ſpine of the os ilium "to manage the reduction in."

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* In inguinal hernia, where the tumor frequently acquires a great bulk, the external pudic (a branch from the femoral artery) is greatly enlarged, and extenſively diſtributed over the ſac.

C, Twigs of arteries from the femoral artery (probably a branch of the upper external pudic artery), diſtributed to the ſac.

D, Inguinal glands.

E, A coat of condenſed cellular membrane, external to the peritoneal ſac. Upon the firſt view of the tumor, on laying back the integuments, the faſcia was continued in fibres from the outſide upon this ſac of cellular membrane, ſo as to form a continued ſheet, holding the hernia embraced amongſt the cellular membrane.

F F, The peritoneal sac, conſiderably thickened.

G, The intestine, a portion of the ilion. If we were to imitate the colour, it would require a deep purple, with a light tinge of lake over it.

The death of the perſon from whoſe body this drawing was taken was in conſequence of the ſtrangulation. If this had been a male ſubject, a view from the inſide would have been given, ſhewing the relative ſituation of the chord, epigaſtric artery, and mouth of the ſac: but the femoral hernia is a rare occurrence in man. The conſequence of inflammation, as exemplified in the preſent caſe, is the matting together of the cellular membrane. Even the femoral artery, and vein, and glands, were embraced by firm unelaſtic fat.

In Plate XV. the dangers of the ſecond ſtage of the operation are pointed out.

FURTHER DISSECTION OF THE ARTERIES AND NERVES OF THE THIGH.

It is needleſs to make a parade of the importance of this diſſection: the next diviſion of our ſubject, which treats of the accidents and diseases, will ſufficiently evince it.

As we have now to diſſect back the general faſcia, and as in ſeparating the muſcles we have much of their connections to attend to, it may be well to point out ſuch circumſtances as may illuſtrate the general deſcription of the faſcia.

In carrying an inciſion through the faſcia above the tract of the femoral artery, and diſſecting back that portion which covers the outſide of the thigh, the direction of the fibres on the outer and on the inner ſurfaces of the faſcia will be found very different, ſhowing the two plates of which it is compoſed. Upon the outer ſurface its fibres run in circles round the thigh; upon the inſide they run in the length, and are more ſilvery and cloſer.

Upon the inſide of the thigh, beſides the coat of cellular membrane which involves the veins, there is a more appropriated ſheath, though by no means like the faſcia on the outſide of the thigh in ſtrength. Upon diſſecting this part of the faſcia from the more ſlender muſcles which come down from the os pubis, it will be found to ſend down interlacing fibres betwixt the muſcles, keeping them in ſome meaſure diſtinct from each other. Of this we have an example in the gracilis muſcle; for when we ſlit up and diſſect back the faſcia which covers it, we ſtill find a condenſed membrane ſeparating it from the triceps.

The femoral artery, as it deſcends from the groin, gets betwixt the tendinous inſertion of the triceps and the origin of the vaſtus internus muſcles. Betwixt theſe two muſcles there is ſuch an interlacing of tendinous filaments, that they form the bottom of a deep groove in which the artery runs.

The great accompanying vein keeps on the inſide of the artery, and turns more and more under the artery as it deſcends to paſs through the triceps muſcle. The vein is very ſtrong in its coats; and perhaps in an operation it might be miſtaken for the artery, if the ſurgeon ſhould be left to judge by the feeling betwixt his fingers, which in many caſes is a good criterion.

NOTE OF THE NERVES WHICH ARE TO BE TRACED AMONG THE MUSCLES ON THE FORE PART OF THE THIGH.

OF THE TRUNK OF THE ANTERIOR CRURAL NERVE.—This nerve commences by a twig from the ſecond lumbar nerve. The third is almoſt entirely expended upon it. It receives likewiſe a twig from the fourth. The body of the nerve lies betwixt the pſoas and iliacus internus muſcle. It comes from under the ligament of the thigh, by the outſide of the femoral artery, and is in part covered by the veſſel. As it lies betwixt the muſcles, it ſplits into numerous branches, which tend downward upon the thigh. It here receives twigs from the lumbar nerves; and it ſends delicate branches to the internal iliac muſcle, and to the pſoas muſcle, viz. recurrentes nervi pſoæ.

OF THE DISTRIBUTION OF THE ANTERIOR CRURAL NERVE.—A very minute knowledge of the muſcular branches will add little to our practical knowledge. In diſſection, when we find a branch of this nerve going to a muſcle, we know its origin and diſtribution, and conſequently its name. Thus, three branches to the ſartorius muſcle.

Nervus muſculi ſartorii brevis vel ſuperior,
——————————— medius,
——————————— longus vel inferior.

In the ſame manner the three nerves of the vaſtus externus: Nervi lividi, or pectinalis, going down upon the pectinalis; nervus muſculi cruralis; nervus muſculi recti, &c.

OBTURATOR NERVE.—Origin commences with a twig from the ſecond lumbar nerve. As it paſſes the third lumbar nerve, it is joined by ſome delicate twigs. It has alſo additional twigs from the fourth lumbar nerve. It comes out from the pelvis by the thyroid hole, conſequently in the middle of the muſcular fleſh of the thigh, and is chiefly diſtributed to the adductor muſcles. In oppoſition to the laſt mentioned nerve, it is ſometimes called the poſterior crural nerve.

EXPLANATION OF PLATE XV.

A, The tendon of the external oblique muſcle of the abdomen, where it forms the LIGAMENT OF THE THIGH *.

B, The SPERMATIC CHORD. The direction of the chord and of the epigaſtric artery behind the ligament are marked by dotted lines, ſhewing the danger in which they ſtand in the operation for the femoral hernia.

C, The SARTORIUS MUSCLE ariſes from the upper ſpinous proceſs of the os ilium, and takes a courſe obliquely down the thigh, and round the inſide of the vaſtus internus muſcle. It is here a little turned from its ſeat, to ſhew the whole courſe of the artery and the muſcular twigs which it receives.

D, The RECTUS MUSCLE.

E, The VASTUS INTERNUS MUSCLE.

F, The VASTUS EXTERNUS MUSCLE.

G, The FASCIA LATA, diſſected from the great muſcles of the thigh, and held back.

H, The PATELLA.

I, The GRACILIS MUSCLE.

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* The origin of the epigaſtric artery from the femoral artery is not ſo diſtinctly ſeen as here repreſented, unleſs the ligament be diſſected up a little.

Plate XV

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K, The SEMI-MEMBRANOSUS MUSCLE.

L, The ILIACUS INTERNUS and PSOAS muſcles, ſinking down to reach the trochanter minor.

M, The PECTINALIS MUSCLE.

N, TRICEPS MAGNUS.

ARTERIES AND NERVES.

1. The FEMORAL ARTERY, coming from under Paupart's ligament.
2. The EPIGASTRIC ARTERY, turning up behind the tendon of the abdominal muſcles. Its courſe is marked by dotted lines.
3. The CIRCUMFLEX ARTERY OF THE ILIUM. It takes its courſe upon the ſpine of the os ilium, and inoſculates with the lower lumbar artery.
4. A ſuperficial branch; conſtant in its diſtribution to the origin of the ſartorius muſcle, the ſkin, and inguinal glands.
5. The INTERNAL CIRCUMFLEX ARTERY. It is ſeen to paſs down, to go round the head of the thigh bone. It ſends branches inwards to the membrane filling up the thyroid hole; ſends muſcular branches down the top of the thigh upon the back part; and continues its courſe, gradually diminiſhing in importance till it reaches the capſular ligament. It ſupplies the ſynovial gland in the bottom of the acetabulum. It is generally a branch of the profunda, ſpringing immediately from its root.
6. A branch from the internal circumflex artery, more commonly derived from the main artery (vide Haller's Tab. I. *m*), which gives off the upper external pudic.
7. The INFERIOR EXTERNAL PUDIC. The pudicæ externæ are irregularly diſtributed to the external parts of generation, and the integuments upon the inſide of the thigh.
8. A cutaneous branch from the femoral artery.
9. The ARTERIA PROFUNDA, the great muſcular artery.
10. The EXTERNAL CIRCUMFLEX ARTERY. It runs under the head of the rectus muſcle; turns round the great trochanter; and is extenſively diſtributed to the back part of the joint. It ſends down extenſive muſcular branches; and twigs derived from this branch emerge from the muſcles upon the outſide of the thigh, even near the knee.
11. From this great branch of the profunda is ſent off the great PERFORATING ARTERIES.
12. The TRUNK of the femoral artery continued, after giving off the profunda. In all this tract, till the artery paſſes the triceps magnus, it gives only ſmall twigs to the muſcles. It lies here betwixt the origin of the vaſtus internus and the inſertion of the triceps muſcles.
13. A cutaneous branch.
14. Branches to the rectus and vaſtus externus muſcles.
15. Branches to the ſartorius muſcle.
16. The GREAT FEMORAL VEIN. It gets more behind the artery as it deſcends. They are ſeen ſinking behind the tendinous fibres, ſent from the triceps to the vaſtus internus.
17. The perforating branch of the popliteal artery. Another perforating branch will be ſeen in the view given of the back of the thigh.
18. This branch perforates the triceps to get into the ham, and runs down (ſuperficially) betwixt the hamſtring tendons, in union with the iſchiatic nerve.
19. ARTICULAR ARTERIES, branches of the popliteal artery.
20. The ANTERIOR CRURAL NERVE.
21. Branches of this nerve to the ſartorius muſcle.

N. B. From a branch of the anterior crural nerve, going to the vaſtus internus, is ſent off the NERVUS SAPHENUS, or CUTANEUS LONGUS. This nerve runs down under the ſartorius; is joined by ſome minute

twigs from the deeper muſcular branches of the obturator nerve. Continuing its courſe, it appears as a cutaneous nerve upon the inſide of the knee. From this proceeding downwards, it is largely diſtributed over the tibia; is intricated with the ſaphena vein; and, finally, ends on the inner ankle and fore part of the foot and toes.

OF THE ACCIDENTS AND DISEASES OF THE ARTERES IN THE THIGH, AND OF THE POPLITEAL ANEURISM.

The view of the femoral artery given in Plate XIV. fig. 1. (where it is ſeen lying imbedded in the groin, and where the relative ſituation of the moſt important parts, and the appearance of the cellular membrane, are ſhewn) points out to the ſtudent the neceſſity of paying attention to theſe parts in the diſſection; for this alone can give him the knowledge which will enable him to recogniſe the parts when disfigured by diſeaſe, or in operations on the living body.

I have had an opportunity of ſeeing every kind of aneuriſm; the operation in ſeveral caſes; but more frequently, and with more improvement, the diſſection. In ſome inſtances, perhaps, the caſes ſtrictly belonged to others. But from ſuch opportunities, I conceive it to be perfectly allowable to draw every poſſible information; although we ſurely ought not to think ourſelves intitled ſo pointedly to detail the caſe as to anticipate the hiſtory of it: and above all, no one is in ſuch circumſtances intitled to give a critique of an operation, or of the practice of an individual; becauſe things eſſential to the caſe, and which may have influenced the practice, may be miſunderſtood. It is as far as the opinion of the accuſer has any influence to condemn a man unheard; for accuſations will find their way in the world where the vindication ſhall not reach.

It has been already mentioned in treating of the diſeaſes of the arteries, how frequent their enlargements are at the flexures of the groin and ham; and the explanation which appeared to be the moſt natural of this circumſtance was there fully detailed (ſee p. 55.) But it is not merely the ſtructure or ſituation of thoſe parts which occaſion the many diſeaſes of theſe arteries; they are beſides expoſed to many accidents.

A wound of the great artery high in the thigh is ſuddenly fatal. If by a ſlighter puncture, or the external wound healing quickly in conſequence of compreſſion, an aneuriſmal tumor ſhould be formed, thoſe connections amongſt the muſcles, which have been carefully pointed out, cannot withſtand the continued impulſe of the blood; but in a ſhort time the blood driving amongſt the muſcles, inſulates them; and upon operation an extenſive irregular cavity is found.

To tie a wound of the leſſer branches of arteries, muſt make a much more difficult operation than where the trunk is pierced; for if it lie deep, others are, in ſearching for the wounded artery, unavoidably cut, and even the great trunk endangered; and on enlarging the wound, there is ſuch confuſion of the effuſed coagulated blood in the interſtices of the muſcles, that the artery is with difficulty found, and extenſive inciſions are neceſſary; which, if not very cautiouſly made, increaſe the evil.

In the encyſted aneuriſm the progreſs of the tumor is ſlow. In a caſe of aneuriſm in the groin, to which I paid particular attention, a ſmall tumor aroſe immediately below the ligament of the thigh. It remained ſtationary a long time; but upon ſome ſlight exertion it ſuddenly enlarged, ſtretching down the thigh. Here its progreſs ſeemed again arreſted for ſome time; but it again encreaſed, and ſhowed, by the knobular figure of its ſurface in its laſt ſtage, theſe three ſucceſſive changes which it had undergone. The ſmaller diviſion of the tumor which firſt aroſe, gradually loſt its pulſation; whilſt the beating was very great in the more extenſive tumors further removed from the ligament. When the two hands were extended over the tumor (for its ſize was ſo great), the beating of the collateral arteries was diſtinctly felt on each ſide round the baſe of the tumor. Though the veins of the thigh were much enlarged (the aneuriſm

compreſſing them as they go up under Paupart's ligament), the limb was not œdematous, which generally happens in ſuch caſes.

The DISSECTION ſhewed exactly what the preceding views of the anatomy would lead us to expect. Upon the moſt prominent part of the tumor, and where the pulſation had been moſt diſtinctly felt, the ſkin and faſcia and ſac of the aneuriſm were blended together. Upon the outſide of the thigh, the firm and tendinous aponeuroſis tied down the aneuriſmal ſac. The aneuriſmal ſac was diſtinct, and ſeparated the cloats of blood from the ſurrounding parts; but ſtill it was impoſſible to diſtinguiſh whence it was derived. The external iliac artery was much enlarged, and oſſified; and alongſt the whole tract of the aorta ſeveral enlargements and oſſifications were found.

We cannot be at a loſs to account for the ſucceſſive ſtages of the growth of the tumor, nor for the want of pulſation in that firſt formed. The tumor in the beginning was probably formed by the dilated coats of the artery, and they were ſuſtained by the uniform reſiſtance of the ſurrounding parts; but upon the failure of ſome of the connections of the faſcia, a ſudden dilatation was allowed, and the tumor ſpread irregularly to the weaker points, and down the thigh, in the direction of the original impulſe of the blood. While the dilatation is ſo ſmall, that the blood keeps moving in it, there is probably no coagulum formed; but when it ſtretches into diſtinct ſacs, the ſtream is diverted from the original channel, and the tumor firſt formed fills with firm coagula, and the pulſation is conſequently ſuppreſſed *.

When the operation for aneuriſm is performed in the groin for a caſe like the preſent, it cannot ſucceed; and the practice of the moſt expert ſurgeons ſhews us the confuſion which is likely to follow. Upon the firſt inciſion for laying bare the ſac, ſo many collateral arteries (which we have noticed to be much enlarged), and the veins, too, which are likewiſe enlarged in that direction, in conſequence of the obſtruction and preſſure of the tumor, pour out ſo much blood, that the whole operation is to be done upon parts covered with blood, where the only guide is the feeling †. In regard to the ligature of the great artery, we muſt be under perpetual alarm; and for the ſpace of two weeks we cannot be aſſured that the failure of the ligature, or rather the ulceration of the coats of the artery by the ligature, will not be inſtantly fatal. Or if the bleeding ſhould for this time be ſtopped by the ſurgeon, the repeated failure of ligatures, and the endeavour to follow up the trunk of the artery below the ligament of the thigh, with the deluge of blood and faint exertions of a patient dying in your hands, make a terrible ſcene.

In following the crural artery in its important diſtribution, as exhibited in Plate XV. we ſee the utility of a thorough knowledge of the anatomy, and of the relation which the ſartorius bears to the tract of the great artery and branches of the profunda; and we muſt be aware how very difficult it is, even with this knowledge, to follow in idea the tract of weapons, and judge of the importance of the arteries wounded.

As the artery deſcends, it approaches the bone; and eſpecially as it turns round to go into the ham, it lies very near it, which expoſes it to be punctured by the ſpiculæ of the bone in fractures. As the artery here is much more firmly embraced by the muſcles than in the upper part of the thigh, there is preſented, in ſuch an accident, upon diſſection a very curious appearance; for the large muſcles, the vaſti, are undermined, and they cover the acquired ſac of the aneuriſm with a layer of fibres, cauſing it to reſemble a ſtrong muſcular bag.

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* See an intereſting paper upon diſeaſed blood veſſels by Dr Baillie, in the invaluable volume of the *Tranſactions of a Society for the Improvement of Medical and Surgical Knowledge.*

† See an inſtructive caſe in "Surgical and Phyſiological Eſſays, by Mr John Abernethy," vol. iii. p. 160.

OF THE OPERATION ON THE FORE PART OF THE THIGH FOR THE POPLITEAL ANEURISM.

Particular attention ſhould be paid to the anatomy of the crural artery, as it pierces the triceps muſcle; with a view eſpecially to the high operation for the popliteal aneuriſm. We ſhall by and bye conſider the preference which the operation performed at this part holds over the older manner of operating for this kind of aneuriſm. The anatomy, as pointed out in the explanation of Plate XV. will ſhew us what parts we are to attend to in the operation; but it may be neceſſary to point out the means of hitting theſe parts accurately on the living body. We cannot ſtudy ſurgical anatomy by diſſection alone; but by a careful examination and compariſon with the points of the living body, which are to be our guides. Here, for inſtance, the courſe of the ſartorius muſcle is of infinite importance. It is not eaſily brought into ſuch action as will ſhew its courſe on the limb; but if a weight be placed upon the ground, and we attempt to ſhove it ſidewiſe with the ball of the great toe, it will be brought to ſwell and ſhew its courſe. The inciſion is to be made upon the inner margin of the muſcle, beginning a little below the middle of the thigh, and following the curve of the muſcle. In purſuing this firſt inciſion under the ſartorius (its upper ſurface being kept in adheſion with the integuments), and betwixt the origin of the vaſtus internus and the inſertion of the adductor magnus into the thigh bone, we find the artery covered by irregular fibres of the faſcia. There appears to be no foreſight nor method of operating which can enſure ſucceſs in this operation, except by guarding againſt too large an inciſion; by the accuracy with which it is made to correſpond with the point of the artery to be tied; and by taking care that, in uncovering the artery, the parts are not too much looſened, eſpecially the ſartorius muſcle. When the wound is extenſive (and it is perhaps impoſſible to avoid it in a big and fat man), a large ſuppurating ſore is the conſequence; and there will be a greater chance of the ſinuſes forming up along the ſide of the artery, which ſometimes takes place even in the moſt dexterous operation. The conſequence of this ſtate of the artery is, that inſtead of being ſupported by the ſurrounding parts, it lies ſurrounded with matter; the ligatures, like ſetons, keep up the diſcharge; and the veſſel ulcerating, the patient dies by the loſs of blood, if not by one guſh, at leaſt by ſucceſſive ſmaller bleedings*. Another circumſtance with regard to the ſartorius muſcle is, that when it is left looſe in the wound, it ſwells and fills up the opening, ſo that the matter is confined.

OF THE ANATOMY OF THE HAM, AND OF THE ANEURISM AT THIS PLACE.

As the anatomy of the ham, and the diſeaſe of the artery, have ſo ſtrict a connection with the ſubject of which we have now been treating, it will be better to finiſh the conſideration of them here, than to leave it for ſeparate explanation after the diſſection of the hip and back part of the thigh.

Upon laying aſide the true ſkin and ſuperficial cellular membrane from the back part of the knee-joint, we have firſt to obſerve, as of the utmoſt importance in the diſeaſes and operations, the ſtrong faſcia which covers the muſcles and great veſſels and nerves. We find a ſtrong layer of fibres coming down obliquely from the outſide, derived from the faſcia lata of the thigh. From the projecting head of the fibula there runs upwards a layer of ſilvery fibres croſſing the firſt. From the tendon of the membranoſus muſcle an aponeuroſis comes down, which, gaining additional fibres as it deſcends, forms a very ſtrong ſheath, covering all the back part of the leg. In other words, betwixt the two condyles of the thigh bone, and from the head of the fibula and betwixt the ham-ſtring tendons, a ſtrong faſcia of interwoven fibres is extended, and this is prolonged down upon the origin of the gaſtrocnemii muſcles and back of the leg.

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* Of this, ſee page 63.

Upon ſlitting up and diſſecting back the faſcia, the great nerve appears. It comes down betwixt the biceps and membranoſus muſcles, on a level with the top of the trochanter. It ſplits into two great branches: the greater continues its courſe betwixt the heads of the gaſtrocnemii muſcles; whilſt the leſſer goes outwardly and obliquely downwards ſuperficially (but under the faſcia). Splitting into branches, there goes off from the leſſer branch, directly in a middle courſe betwixt the gaſtrocnemii muſcles and faſcia, a ſmall nerve, which is accompanied by a conſiderable vein. But theſe will be more minutely detailed in the ſucceeding part of the work.

Below the nerve, and the ſuperficial vein and long ſlender artery which accompanies it, there is much cellular membrane and fat. Under this fat, and cloſe to the bone, lie the popliteal artery and vein. They are imbedded in this tiſſue, and are intimately connected together; the vein more outwardly in its uninjected ſtate clinging round the artery, and the leſſer branches of veins ſtriding over it.

If the parts be accurately retained in their natural ſituation during diſſection, it will be ſeen that, in order to find the eaſieſt acceſs to the artery in operation, our inciſion ſhould be made rather towards the outer hamſtring than immediately in the middle. By this means we keep to the outſide of the iſchiatic nerve. We ſhall find the artery lying deep and covered with the vein; and to tie it ſeparately, it muſt be diſentangled from under the vein. But let us conſider the ſtate of the parts in diſeaſe.

STATE OF THE PARTS IN POPLITEAL ANEURISM.—The limb is generally œdematous; ſometimes ſo much ſo as to make the pulſe at the inner ankle to be felt with difficulty, independently of its faintneſs from the aneuriſm. The limb is in general conſiderably bent. Round the whole knee-joint there is much ſwelling; ſo that the tumor in the ham is not very diſtinct, but has more the feeling of general tenſion.

Upon laying open the integuments, the tumor comes more diſtinctly into view, diſtending the faſcia.

With regard to the appearance and ſituation of the parts, particularly of the nerve, and great vein, and leſſer ſaphena, it muſt depend upon the direction in which the coats of the artery firſt give way. If, as in the annexed Plate, the artery ſhall have given way towards the inſide, then the tumor will increaſe in that direction chiefly; while the artery itſelf will, in ſome degree, be puſhed in the oppoſite direction, and the nerve and the vein will be crowded towards the outer hamſtrings.

For the ſame reaſon, when the tumor, while yet ſmall, has got to the outer ſide of the veſſels, as it enlarges it puſhes them towards the inſide; or the nerve may even be carried directly forward upon the tumor. The natural anatomy, therefore, can only teach us the appearance of the parts, enabling us quickly to recogniſe them; but we can never *à priori* know their ſituation in this diſeaſe. In viewing Plate XVI. we ſhould immediately determine, that the tumor could not originate from the coats of the artery, nor be an extenſion of them, ſince the tumor is ſo abrupt and circumſcribed, and the artery immediately above partakes ſo little of the enlargement. It is only by obſerving the progreſs of ſimilar tumors in the breaſt and belly, that we are convinced of the great dilatation which membranes will allow. They acquire ſo gradually additional ſtrength and increaſe of thickneſs, that unleſs we were in a manner witneſs of the gradual change in the nature and properties of the arterial coats, we could not doubt that theſe tumors were formed by the cellular membrane gradually condenſing, in conſequence of inflammation and the impulſe of the blood.

The popliteal aneuriſm takes place exactly in that part of the artery which muſt accommodate itſelf to the flexure of the joint. It would appear, however, that ſometimes it occurs lower, in conſequence of ſome violent action of the heads of the gaſtrocnemii muſcles, or where the arteries of the leg are given off. The oſtenſible reaſon for the new method of operating, viz. on the fore part of the thigh, is, that the artery may be ſuppoſed to partake more of the diſeaſe, in proportion to its proximity to the tumor. But

this is putting the merit of the operation upon an inſecure footing; for we know that the diſeaſed ſtate of the arterial ſyſtem is always greater towards the trunks, and that it is gradually encroaching upon the extremities; that the diſeaſe is common to all the ſyſtem, though the peculiar ſituation of the artery ſubjects it to additional riſks. Theſe may even be increaſed by the circumſtances of a patient's general habits or way of life; but eſpecially this diſeaſe is frequent in ſuch as keep the joint habitually bent, but are liable to occaſional violent efforts of the limb, and chiefly of the gaſtrocnemii muſcles. It was formerly obſerved, that horſemen were more eſpecially expoſed to it; and that claſs of men ſtill continue to be the great ſufferers by this diſeaſe. Whatever may be our reaſoning upon this fact (ſee p. 55.), it is evidently to be attributed to ſome cauſe which affects the portion of the artery which is ſubject to the flexion of the joint only; and if the ligature can be as eaſily and effectually ſecured three inches above the joint as upon the fore part of the thigh, it will be as effectually removed from thoſe cauſes of failure of the artery which are peculiar to the joint, and there will be leſs chance of the general affection of the trunks having reached ſo far. The better reaſons for preferring the new operation ſeem to be, the difficulty of operating in the ham; the depth at which the artery lies; and conſequently the difficulty of drawing the ligature accurately: and when the operation ſucceeds, a permanent contraction of the limb is apt to remain, probably ariſing from the great nerve being ſo much expoſed in the operation, that it muſt partake of the inflammation, and remain in the midſt of the parts condenſed and hardened in conſequence of it. The power, or conveniency rather, which the higher operation gives of tying the artery again and again, following it up the thigh as the ligature ſucceſſively give way, is but a forlorn hope; whilſt in the lower operation, amputation can be more conveniently done, and with better expectation of ſucceſs. But the ſuperiority of the new operation muſt be finally determined by thoſe gentlemen whoſe ingenuity and profeſſional ſkill have already done ſo much, and whoſe opportunities are unlimited.

EXPLANATION OF PLATE XVI.

In this inſtance, the operation above the triceps muſcle proved unſucceſsful.

A, The INNER HAMSTRING muſcles.

B, The OUTER HAMSTRING muſcles.

C, Fat left undiſſected. A maſs of fat is ſeen filling up the ſpace betwixt the origins of the gaſtrocnemii.

D, The INTEGUMENTS fallen down over the back of the leg.

E, The ANEURISMAL TUMOR.

F, The artery above the tumor, lying deep and near the bone.

G, A leſſer vein, ſtretching over the artery to accompany ſome of the articular arteries.

H, The GREAT POPLITEAL VEIN, ſeparated from the artery by the enlargement of the tumor. When this vein is much compreſſed, the leſſer ſaphena vein is proportionally enlarged.

I, The ISCHIATIC NERVE.

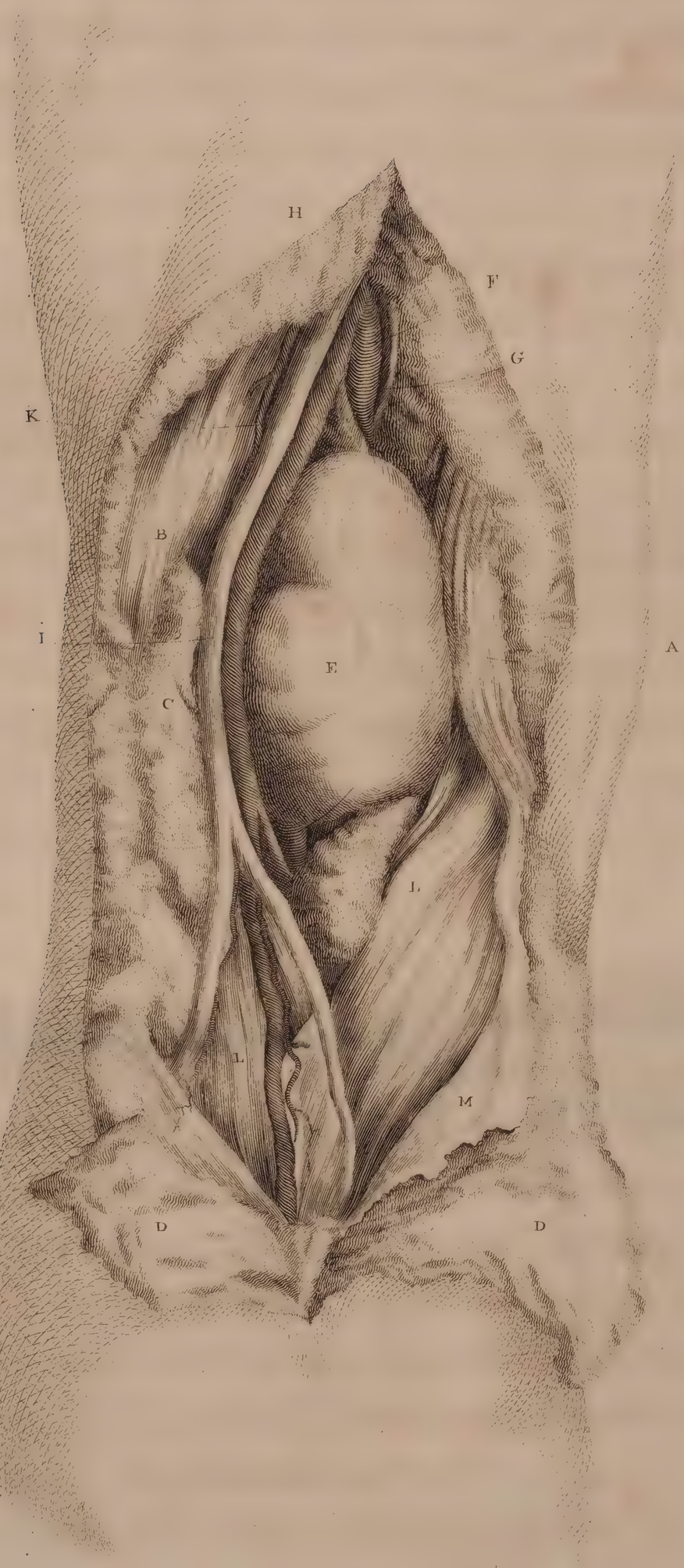
K, A branch of the FEMORAL ARTERY, above the triceps, accompanying the nerve in its courſe.

L L, The ORIGINS of the gaſtrocnemii muſcles.

M, The FASCIA diſſected back.

OF THE CHANGES WHICH TAKE PLACE IN THE CAPACITY AND ACTION OF ARTERIES WHEN TIED, AND THE CIRCUMSTANCES WHICH INFLUENCE THESE CHANGES.

As morbid anatomy, or the changes which diſeaſe occaſions, and the effect of operations upon the neighbouring parts, deſerve ſo much of our attention; and as the laws by which the arteries in theſe caſes are influenced prove ſo uſeful and curious an enquiry, and ſo neceſſary to be remembered in determining



Drawn by Charles Bell.

Engraved by Jn. Grant.

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upon every operation, I ſhall here endeavour to lay before the reader a few of the more important circumſtances which influence the arteries.

What I now moſt anxiouſly wiſh to explain is, the connections and ſympathies of the trunks of veſſels ſupplying a limb with the changes in the limb or part of the body which they ſupply. When part of a limb is amputated, the trunks of the arteries which ſupplied it rapidly diminiſh in ſize, and contract their diameter. If the lower part of a limb mortify, and the diſeaſe gradually encroach upon the limb, and ſpread upwards, the activity of the arteries is found proportionally decreaſing, and their diameter ſhrinking; inſomuch that if it be thought fit to amputate the limb above the diſeaſed part, the ſize of the arteries will be found diminiſhed, and the bleeding conſequently leſs. In theſe circumſtances, the leg has been amputated without the neceſſity of tying the arteries on the ſtump *; and, upon diſſection, it is found that the arteries in mortified parts are ſtopped with coagulated blood.

In contraſt with this, we have to contemplate the changes to which the arteries are ſubject in the natural growth of the body, or when an adventitious tumor grows upon a limb. As a limb enlarges in the courſe of nature, the arteries ſupplying it increaſe in ſize and ſtrength. No one in theſe days will ſay, that this is merely a dilatation of the artery; on the contrary, it is an increaſe of ſize, ſtrength of coats, and energy of action. In the caſe of an adventitious tumor growing upon a member, we find the arteries of that member gaining ſtrength and increaſe of capacity, and enlarging their diameter, and becoming more tortuous proportionally as the tumor increaſes in ſize. In reaſoning upon theſe facts, Dr Hunter writes thus *: "Every body muſt ſee, that in this caſe the trunk of the artery would dilate till it became proportionable "in capacity to its branches; for till then the trunk would be the narroweſt part of the canal, the part "where there would be the moſt reſiſtance; and therefore the yielding coats of the artery would give way "till the juſt proportion was eſtabliſhed between the trunk and all its branches." This explanation proceeds upon a falſe principle; for although the trunk of the artery may be ſuppoſed proportionably narrower than the branches, yet as it is not narrower now than formerly, why ſhould it give more reſiſtance than formerly? Should not the greater diameter of the extremities rather lead to the inference, that ſince the reſiſtance to the paſſing forward of the blood is diminiſhed, the force of the blood laterally upon the trunk of the veſſel is likewiſe diminiſhed? But this is not the way in which the difficulty is to be ſolved: It is evident that an increaſe of blood is ſent to the limb; and the queſtion is, How is this beſtowed? It is obſervable by every one in any degree converſant with the trifling accidents and local diſeaſes of the body, that where there is an injury, an inflammation, a ſwelling, whether inflammatory or indolent, there is, according to the importance of the tumor, a ſtrict connection and ſympathy betwixt the diſeaſed part, and the veſſels more or leſs remote by which it is ſupplied. Where there is a ſmart inflammation, there is a very perceptible increaſe of action quickly ceaſing with its cauſe. Where there is an indolent tumor, there is a more imperceptible, but permanent, change in the ſize and activity of the veſſels. In this view, I hope, it will appear that the explanation, which reſts merely upon the diſtention and dilatation of the arteries by the blood, is but lame and imperfect; and that it will be evident, that in the veſſels of a limb, when influenced by a great tumor growing upon it, the ſame change takes place as under the influence of the natural growth of the limb from childhood.

Let us take the queſtion in another light. Let us trace the obſervations of Dr Hunter to the phenomena which gave riſe to his moſt ingenious reflections, viz. the caſe of varicoſe aneuriſm, in the 2d volume of the Medical Obſervations.

In that ſpecies of aneuriſm in which a communication betwixt the artery and vein is formed in the bend of the arm, and by which a proportion of the blood which ſhould circulate in the arm is drawn aſide from the trunk of the artery into the baſilic vein, and finds a leſs circuitous rout back to the heart, it ſeems in-

* See Medical Obſervations, Vol. II.

variably to happen that the brachial artery is enlarged from the axilla down the arm to the communication. It becomes larger, and more tortuous, and its pulsation is more distinctly felt. This increase of diameter and strength, Dr Hunter ascribes to the derivation of blood by the aperture, and reasons upon it in the words already quoted; conceiving this derivation of blood to act in a manner analogous to the adventitious tumor growing upon the limb. Did the motion of the blood in the arteries depend upon the laws of hydraulics simply—this breach in the vessel, this less circuitous rout back to the heart, giving an easier circulation than through the extreme vessels, the supply of blood to the fore-arm would be permanently diminished. But the laws of the economy have directly a different tendency: for as the natural growth of a limb has an immediate effect (by what sympathies or mode of action we must remain ignorant) in enlarging the parent trunk, soliciting a greater action and supply of blood; and as, after the natural increase of the limb is arrested, a preternatural tumor growing upon the member will still farther increase the agency of the vessels, it is natural to infer, from such strong analogy, that it is the influence of the fore-arm which occasions the increase of strength in the brachial artery; that the breach in the artery has withdrawn a quantity of blood from the arm, which is supplied by a more vigorous action in the trunk of the artery.

Of the collateral arteries in aneurism.—But it is only from a more extensive view of the changes which take place in arteries, that we can form a decided opinion respecting the circumstances which affect them. We should naturally conceive, upon a superficial view, that when the trunk of an artery is tied, the collateral arteries enlarge merely as a consequence of the greater impulse of blood into them. But it is evident, that it is not the impinging of the blood upon their coats which distend them; since, when their extremities are tied, as after amputation, they do not dilate: and from an examination of the collateral arteries in aneurism, we see, that there is not a dilatation or extension of the coats merely, but at the same time an increase of strength and thickness of the coats, as in the natural growth of the arteries. We have to show how the arteries become tortuous, also, as they increase in power; and we hope to show, that this tortuous figure of the artery is the great means of the additional exertion.

In Dr Hunter's remarks upon the case already quoted, there are several instances of the serpentine course which arteries take, as illustrating the increase and convolutions of the artery of the arm in aneurismal varix. This change he supposes to happen, "because the artery is lengthened, and therefore can-"not preserve its course;" and that it is lengthened by the distension of the blood. Mr John Bell, in his Anatomy of the Heart and Arteries, has objected to the reasoning of Dr Hunter, but has come nearly to the same conclusion: "It is merely (says he) a consequence of the long continued pressure "of the blood: it is this only which can account for the slowly increasing tortuosity in the temples "or hands of an old man, or the sudden tortuosity which the newly dilated artery assumes after the "operation for aneurism." (P. 291.) When the functions of an artery are considered, this matter will appear in a different light. As the artery possesses a power of accelerating the blood, or of circulating it by an action alternating with the heart, the force exerted by an artery upon the blood must be in proportion to the length of the artery. A portion of an artery, of the length of three inches, will have a greater power of accelerating the blood than one of two inches, though they are equal in diameter; there being in the one a greater latitude of action than in the other. The combination of the muscular reaction of the first artery, exerted to accelerate the blood, will, when compared with that of the other, be as three to two. It follows, therefore, that the increased length of an artery, which has assumed the serpentine zig-zag course which arteries take in the several instances already mentioned, as in the temporal arteries when a great tumor grows upon the head, in the collateral arteries in aneurism, and in the brachial artery in the aneurismal varix, is a means of additional force and power to the circulation. It seems to depend upon the same principle, and to be consonant with the same laws, which influence the increase of the artery in diameter and in muscular strength. That part of the member which remains

beyond the ligature of the artery in the operation for aneuriſm, comes to act upon the collateral branches in a manner ſtrictly analogous to the way in which a great tumor growing upon a limb, or upon the head, acts upon the arteries of the part. The arteries become enlarged and tortuous, with an increaſe of pulſation and force; or the limb acts upon its collateral arteries as its growth did upon the trunk, there being ſuch an effect mutually exiſting betwixt the increaſe of the member in bulk, and the capacity and energy of the arteries which ſupply it. The ſerpentine form of the arteries in old age is the natural courſe of the economy acting in a uniform tenor from childhood. It is a mark of the gradual failure of the activity of the arteries; and at the ſame time a temporary relief from that failure, and a means of ſupporting the action of the ſyſtem.

The increaſe of the collateral arteries after the operation for aneuriſm, which from experience we know to be the harbinger of a ſucceſsful termination, and of the cloſing of the trunk, is to be accounted for upon the ſame principle. It ſhows a degree of youthful pliancy in the branches; it proves that the influence of the limb has ſucceeded; that the current of blood has changed; and that the trunk of the artery is left dormant to take thoſe changes, which are completely to preclude the flow of blood. (See page 63. Of the State of the Veſſels in Abſceſs.)

The numerous melancholy inſtances of the death of patients from the operation of aneuriſm, teach us the importance of attention to the ſtate of the ſyſtem in determining upon the operation. If the patient be young, and the aneuriſm have been produced by an accident, as a violent ſtrain and twiſting of the knee-joint, the ſpiculæ of a fractured bone, puncturing of the artery, &c. to tie the artery, even by an operation apparently bold or fool-hardy, will be attended with ſucceſs; and ſo all experiments upon animals will be. But we muſt not be miſled to conceive that, without regard to circumſtances, an operation, if done after a certain manner, and with ſuch and ſuch ſtages, ſhall be univerſally ſucceſsful. It is to the ſtate of the patient that we are chiefly to look. A man far advanced in life, with a diſeaſed ſtate of the arteries, will fall a ſacrifice, however dexterouſly the operation may be performed. The collateral arteries will not be in a ſtate to take an increaſed action, and to enlarge, ſo as to give a new rout to the blood, and make a complete derivation from the trunk, which is tied. But the blood making an effort to keep in the old channel, will retain the artery unſealed by the coagula, which ſhould form in it; and in a few days the ligature cutting its way out by the ulceration of the artery, there will be a profuſe bleeding.

It may be uſeful to obſerve the conſequences of amputation to ſuch a patient, and the changes which we know to take place. After amputation, there is a diminiſhed energy of action in the whole remaining arteries of the limb, and a real permanent contraction of the trunk of the artery and of the ſmaller branches, the extremities of which were diſtributed to the amputated parts. When we conſider that, in general, in aneuriſm the arteries are in a diſeaſed ſtate, and that their partial failure is to be taken as a proof of this, is not the diminution of the diameter of the artery, and of the velocity of the blood, the moſt likely way to ſecure the remaining part of the artery from the further effects of diſeaſe? Is it not moſt likely that, by allowing it a more quiet ſtate, this may ſecure the patient from the formation of ſucceſſive aneuriſmal tumors in the arteries connected with that limb? Thus differently do facts prove the caſe to ſtand from what a ſuperficial obſervation would lead us to infer. We ſhould conceive, that the amputation of a limb would endanger the remaining ſtump by the greater impulſe communicated to the obſtructed extremities.

In offering theſe remarks, I mean only to illuſtrate the laws of the animal economy in theſe diſeaſes; not to draw unwarily a practical concluſion: for in determining upon the propriety of amputation, there are circumſtances to be attended to which do not fall under our conſideration; and particular attention muſt be paid to what has been obſerved as the conſequence of amputation to a ſyſtem unreduced by previous diſeaſe.

DIRECTIONS TO THE BINDER.

PLATE XIII. to face - Page 94

PLATE XIV. - - - 100

PLATE XV. - - - 104

PLATE XVI. - - - 110

Edinburgh:

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1799.

A

SYSTEM

OF

DISSECTIONS,

PART V.

CONTAINING

DISSECTIONS OF THE BACK PART OF THE THIGH, AND OF THE LEG AND FOOT.

WITH PLATES.

BY CHARLES BELL, SURGEON.

EDINBURGH:

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1799.

SYSTEM

OF

DISSECTIONS.

DISSECTION

OF THE

ISCHIATIC AND POSTERIOR ILIAC ARTERIES, AND PARTS ABOUT THE HIP-JOINT.

THE glutei muſcles are groſs and flabby; and ſo much cellular ſubſtance and fat is entangled with their coarſe fibres, that it is difficult to make a neat diſſection of them. But this is a very important diſſection; it is much connected with that of the perineum; and both parts are much expoſed in falls, to dangerous bruiſes; and to deep wounds, from ſitting unwarily down upon ſharp points; fiſtulous ſinuſes too, ſometimes take their courſe amongſt the cellular membrane, and ligamentous parts here.

When the ſkin and fat are diſſected from the great gluteus muſcle, and when this muſcle is lifted from its origin, and left hanging by its tendon, a great branch of the gluteal artery is ſeen to emerge from betwixt the gluteus medius and pyriformis muſcles; one diviſion of this artery extends round upon the ilium, and ſends twigs backwards upon the ſacrum, while another lies betwixt the gluteus maximus, and the gluteus medius.

The third branch of the gluteal artery is to be followed under the gluteus medius. Without raiſing this muſcle, but by undermining it, holding it aſide, and expoſing the GLUTEUS MINIMUS, we ſee the whole courſe of the gluteal artery, and can underſtand the effect of punctured wounds at this place; and how the aneuriſmal blood forces up theſe muſcles from the os ilium, deſtroys the cellular membrane, and diſtends the coarſe fibres of the muſcles into the ſac of the aneuriſm.

The ARTERIA ISCHIADICA comes out from under the pyriformis, whilſt the gluteal artery appears on its upper edge. The iſchiatic artery and the great nerve come out together betwixt the pyriformis muſcle, and the ſacro-iſchiatic ligament. This artery lying upon the back part of the hip, is under the gluteus maximus; it ſends its branches round towards the anus, to the perineum, to the upper part of the thigh, and inoſculates with the internal circumflex artery.

For continuing the diſſection down the thigh, there is no further knowledge neceſſary than what may be ſufficiently acquired from the plate; unleſs perhaps a ſlight note of the cutaneous branches of the iſchiatic nerve be required.

CUTANEOUS BRANCHES OF THE ISCHIATIC NERVE, IN THE BACK PART OF THE THIGH AND HAM.

NERVUS CUTANEUS POSTERIOR ET SUPERIOR is the firſt branch of the great nerve, before it has eſcaped from the pelvis; having run parallel with the great nerve for ſome way, it takes an additional ſlip from it. It divides itſelf into four branches. The FIRST coming out from under the gluteus muſcle, holds its courſe inwards to the ſcrotum and inſide of the thigh: The SECOND branch having divided, pierces the faſcia, and is loſt upon the faſcia and ſkin: The THIRD branch follows nearly the ſame track, but extends further down the outſide of the thigh: And the FOURTH runs down the middle and back part of the thigh reaching to the ham; it appears firſt by the inſide of the great head of the biceps muſcle.

NERVUS CUTANEUS INTERNUS SUPERIOR.—This nerve riſes in common with a branch going to the long head of the biceps muſcle; after which it proceeds ſuperficially down the inſide of the thigh.

NERVUS CUTANEUS INTERNUS INFERIOR is diſtributed to the inſide of the thigh and knee. This branch comes off from the iſchiatic nerve, after it has paſſed the QUADRATUS FEMORIS muſcle; and, nearly in the ſame place, is given off a MUSCULAR BRANCH TO THE QUADRATUS FEMORIS.

Nearly about the middle of the thigh bone, there goes off outwardly a very conſiderable branch, which is diſtributed entirely to the muſcles, to the adductor magnus, ſemi-membranoſus, ſemi-tendinoſus, and biceps.

NERVUS CUTANEUS EXTERNUS.—This branch appears ſuperficially above the faſcia, on the outſide of the knee, and takes its courſe upon the outſide of the leg. Higher upon the outſide of the thigh, the cutaneous nerves are derived from thoſe coming out upon the groin.

EXPLANATION OF PLATE XVII.

This plate is taken from Haller; becauſe, after a good injection and careful diſſection, the parts will come very much into this form—I diſregard the letter-preſs of Haller; but mark, as I have hitherto done, the leading points in the anatomy and manner of diſſecting,

PROMINENT POINTS OF BONE AND MUSCLES.

A, The dorſum of the ilium.

B, The os ſacrum.

C, The tuberoſity of the iſchium.

D, The ſacro-iſchiatic ligament.

E, Trochanter major.

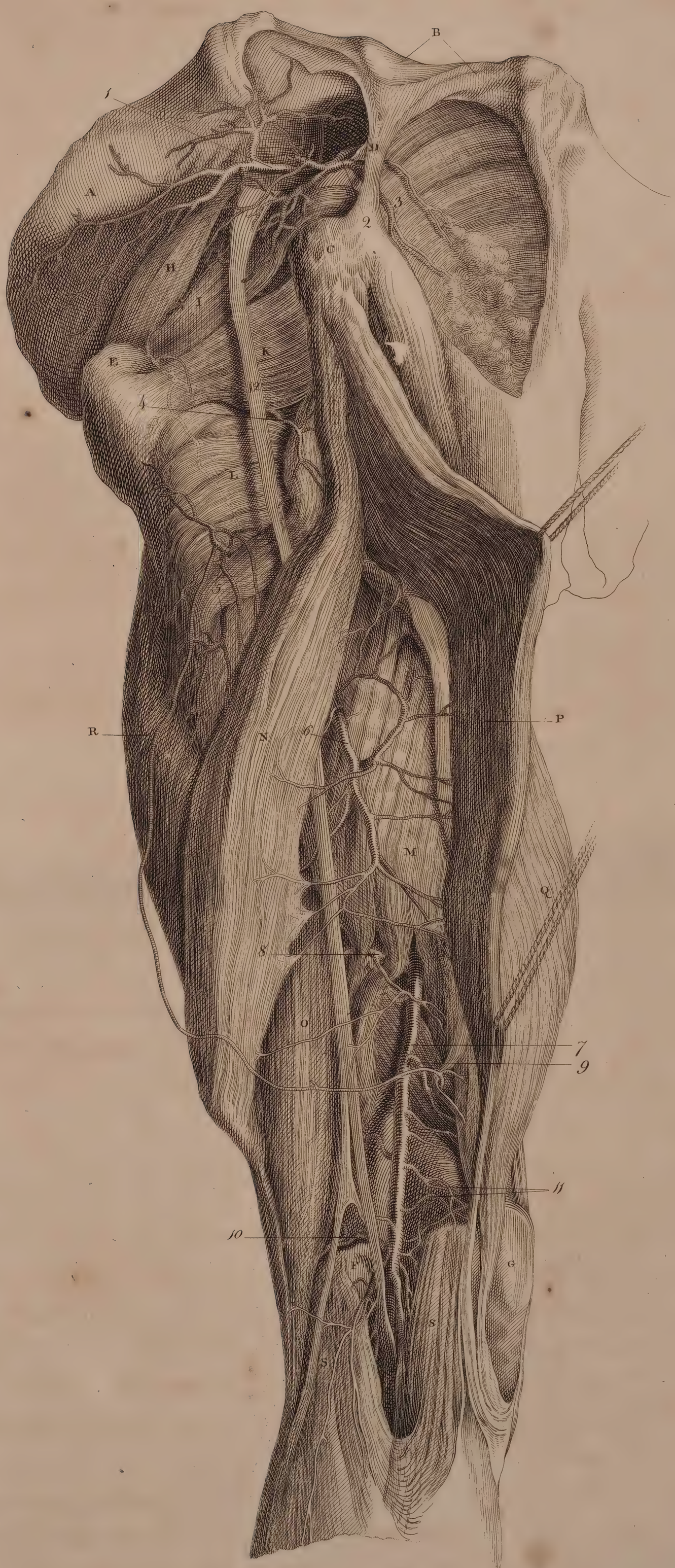
F, The internal condyle of the thigh bone; G, the external condyle.

H, The PYRIFORMIS muſcle; which, ariſing from the hollow of the os ſacrum within the pelvis, is inſerted into the root of the trochanter major.

I, The GEMINI and OBTURATOR INTERNUS. Theſe muſcles are very poorly expreſſed here: But in the diſſection, the ſtrong and well formed tendon of the obturator will be obſerved coming out betwixt the ligaments, from its extenſive origin from the membranes of the thyroid hole; and on each ſide of this, the gemini, viz. two fleſhy ſlips, ariſing from the os iſchii, and inſerted into the trochanter major.

K, QUADRATUS FEMORIS; a flat, ſquare muſcle, paſſing from the iſchium to the root of the trochanter.

Plate XVII.



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L, TRICEPS BREVIS croſſing the middle of the thigh, from the ramus of the os pubis to the trochanter and linea aſpera.

M, The TRICEPS MAGNUS; through which the artery is ſeen to paſs.

N, The long head of the BICEPS FLEXOR coming from the iſchium.

O, The ſhort head of the BICEPS riſing from the thigh bone:—the tendon of this muſcle is the outer hamſtring.

P, The SEMII-TENDINOSUS—it is inſerted into the head of the fibula; is ſeen riſing from the tuberoſity of the iſchium;—it adheres for ſome way to the biceps, but parting with it, leaves the back of the knee-joint unprotected;—it is inſerted into the head of the tibia.

Q, The SEMI-MEMBRANOSUS having nearly the ſame origin and inſertion with the laſt muſcle, theſe two form properly the inner hamſtring tendons.

R, The VASTUS EXTERNUS MUSCLE.

S, S, The heads of the GASTROCNEMIUS MUSCLE.

ARTERIES AND NERVES.

1, The GLUTEAL OR POSTERIOR ILIAC ARTERY.

2, The PUDIC ARTERY, which ſeems to have been here in common with the iſchiadic.

3, The artery to the penis; which is ſeen to give arteries to the levator ani, and perineum.

4, The extreme muſcular branches of the internal circumflex artery, (5, Plate XV). It inoſculates with the iſchiatica.

PERFORATING ARTERIES OF THE PROFUNDA FEMORIS.—Theſe are ſuch branches of the profunda as perforate the triceps muſcle (which, in ſome meaſure, forms a plane of diviſion betwixt the fore and back parts of the thigh), and are diſtributed amongſt the flexor muſcles.

4, The extreme branches of the INTERNAL CIRCUMFLEX ARTERY, Plate XV. 5.—which being frequently a branch of the profunda, is the FIRST PERFORATING ARTERY.

5, The FIRST PERFORATING branch of the profunda, ſent chiefly to the triceps brevis.

6, The SECOND PERFORATING ARTERY, ramifying to the biceps, ſemi-membranoſus, and ſemi-tendinoſus muſcles. Theſe muſcular arteries, the extreme branches of the internal articular arteries, the firſt and ſecond perforating arteries, form a train of inoſculations, reaching from the iſchiatic artery to the popliteal artery.

7, The TRUNK OF THE POPLITEAL ARTERY, where it has perforated the triceps muſcle, and lies cloſe upon the bone.

8, A conſiderable muſcular branch, ſent off as the artery is paſſing the triceps muſcle, and which is chiefly diſtributed to the biceps.

If, as in all probability, there was in this ſubject a great muſcular branch coming off oppoſite to this one, and which in many ſubjects is diſtributed to the inner hamſtring muſcles and vaſtus internus, it would be the FIRST PERFORATING ARTERY of the popliteal artery; while this (8) is THE SECOND PERFORATING ARTERY. THE PERFORATING ARTERIES of the popliteal artery, are thoſe branches which eſcape from the hollow betwixt the hamſtring tendons, and paſs through the flexor muſcles.

9, A muſcular branch to the ſemimembranoſus muſcle, which ſends a long reflected branch, inoſculating with the perforating arteries of the profunda, upon the great faſcia of the thigh.

The ARTICULAR ARTERIES, which are branches of the popliteal artery above the condyles, are in ſyſtematic arrangement three in number, but they are very irregular. That branch however marked (10), the lower and external articular artery going over the outer condyle, is very conſtant; while for the internal articular artery, as it has occurred here, there is more frequently ſubſtituted leſſer branches.

11, THE AZYGOS ARTERY OF THE JOINT, which takes a middle courſe betwixt the condyles, is frequently a branch of the outer articular artery.

12, The great iſchiatic nerve ſeen through its whole courſe.

DISSECTION OF THE BACK PART OF THE LEG.

In page 108, when treating of the popliteal aneuriſm, a ſlight deſcription of the faſcia which ſtretches acroſs the hamſtring tendons, and of the ſituation of the great veſſels and nerves was given. To purſue the diſſection of the popliteal veſſels and nerves, the faſcia upon the belly of the gaſtrocnemius muſcle is to be ſlit up. We find there the leſſer ſaphena vein coming up from the outſide of the foot, its trunk lies under the faſcia, and ſhines through it while yet entire; it joins the popliteal vein betwixt the hamſtring tendons, about two inches above the condyles; in its courſe it forms ſeveral remarkable inoſculations with the ſaphena major, and is accompanied by two ſuperficial branches from the peroneal and fibial nerves. We find alſo that the great ſaphena vein upon the inſide, is accompanied with a ſmall nerve, the INFERIOR INTERNAL CUTANEOUS NERVE; which ariſes from the ſchiatic nerve ſoon after it has come out from the pelvis, and which emerges only at the inſertion of the ſartorius muſcle.

Having diſſected the parts in the back of the knee joint, and the gaſtrocnemius muſcle, particular attention ſhould be paid to the apponeurotic expanſion, inveſting the flexor muſcles, and poſterior tibial artery and nerve; for betwixt the ſtrong tendon of the gaſtrocnemius and the edge of the tibia, the ſtrong croſs fibres of a faſcia are extended; and even this being ſlit up, a tough cellular membrane intervenes, betwixt the flexor muſcles and the artery and nerve; and theſe muſcles are further encloſed in a peculiar apponeurotic membrane.

Theſe things are remarked, as in themſelves important, and to be noticed in the diſſection not explained in the Plate.

EXPLANATION OF PLATE XVIII.

FIG. 1.—MUSCLES.

A, The inner hamſtring tendons, formed by the ſemi-membranoſus and ſemi-tendinoſus muſcles.

B, The outer hamſtring, or tendon of the biceps cruris.

C C, The origins of the GASTROCNEMIUS MUSCLE, from the two condyles of the thigh bone. The belly of the muſcle D D, is ſcarcely more than indicated by an outline.

E, The belly of the SOLEUS MUSCLE, appearing from under the gaſtrocnemius; this muſcle ariſes by two heads from the upper part of the tibia and fibula—it forms a broad flat muſcle, of which the margin only is ſeen here—its fibres concentrating to a middle tendinous line F, coaleſce with the tendo Achilis F; which is thus common to both theſe muſcles.

G, The PLANTARIS MUSCLE, which riſing from the external condyle of the thigh bone, lies under the gaſtrocnemius muſcle—it has a ſmall fleſhy belly of about three inches, and terminates in the delicate tendon H, which lies betwixt the inner head of the gaſtrocnemius and ſoleus, as the oblique direction of the muſcle indicates—its tendon adheres to, and is implanted alongſt with the tendo Achilis.

1, The tendon of the TIBIALIS POSTICUS, paſſing in its ſheath under the inner ancle. This muſcle riſes from the back part of the tibia and fibula, and interoſſeous ligament, while its head ſtretches through be-

Fig. I.

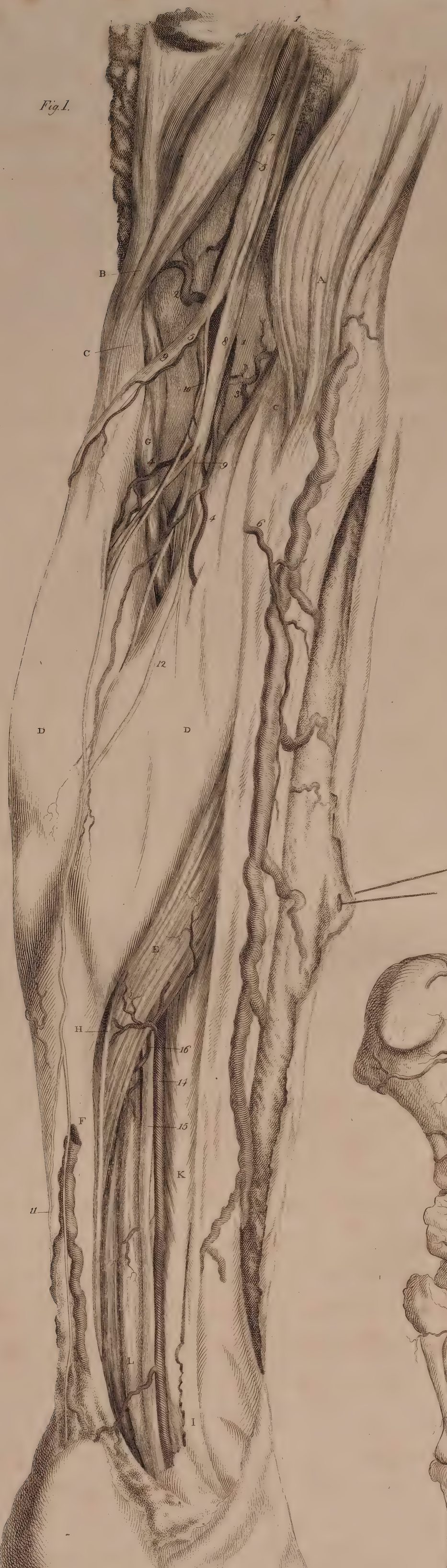
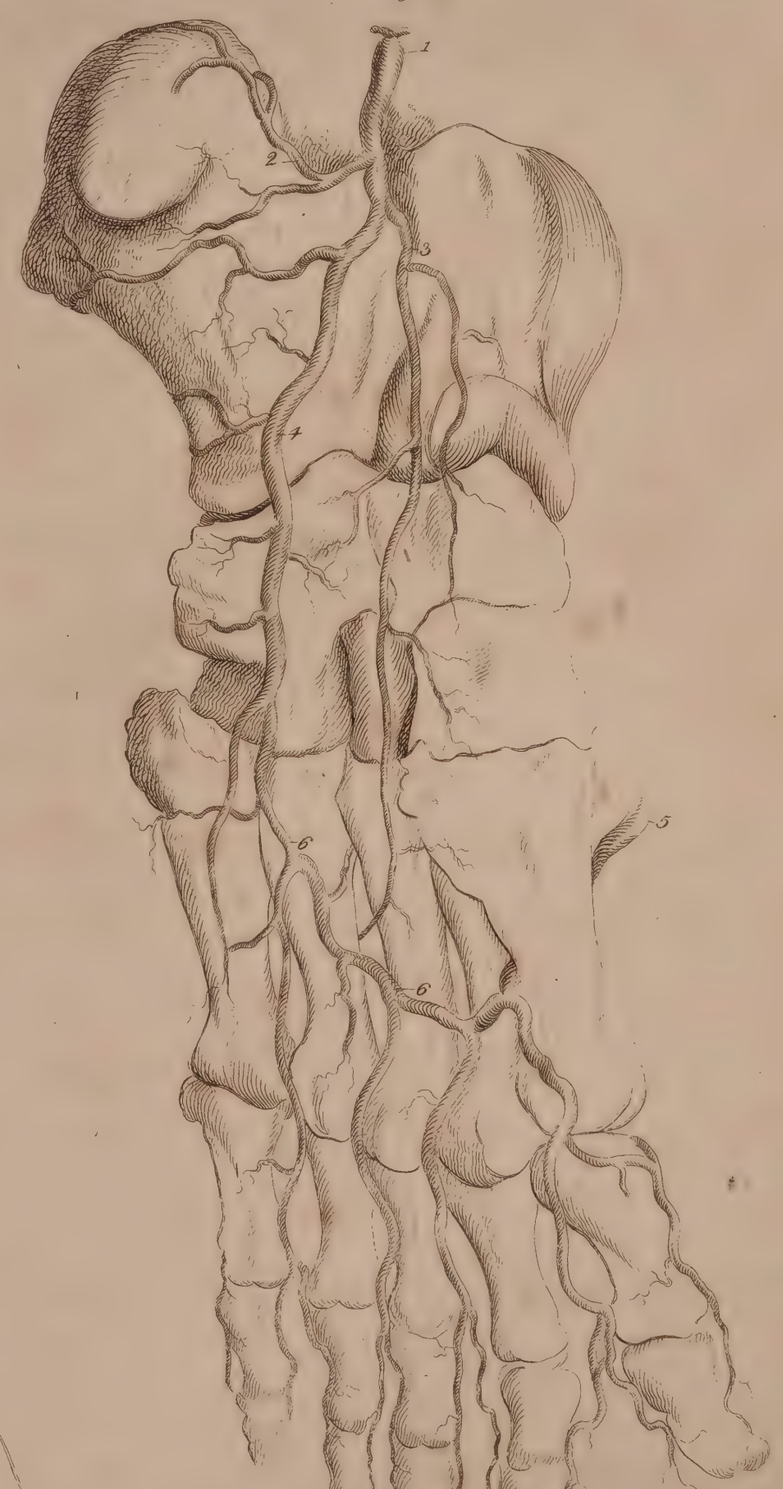


Fig. II.



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twixt the bones, and takes its origin from the tibia before—its tendon ſpreads widely over the tarſal and metatarſal bones in the ſole of the foot.

K, The FLEXOR LONGUS DIGITORUM.—It ariſes from the back part of the tibia. The fibres converging from the outer and inner ſharp edges of the bone, encloſe the tibialis poſticus, which lies cloſe upon the bone—inſerted into the laſt bone of the four leſſer toes.

L, The FLEXOR LONGUS POLICIS PEDIS.—It riſes from the back part of the fibula, a little below its head, and continues its origin almoſt to its lower extremity—paſſing under an annular ligament, it is inſerted into the laſt joint of the great toe.

ARTERIES AND NERVES IN THE BACK OF THE KNEE-JOINT.

1, The POPLITEAL ARTERY, where it lies deep betwixt the hamſtring tendons.

2, The UPPER AND OUTER ARTICULAR ARTERY.—It is ſeen again in Plate XX. Fig. 3.—It paſſes here under the tendon of the BICEPS CRURIS.

3, The UPPER AND INTERNAL ARTICULAR ARTERY paſſing through the tendon of the triceps, and piercing the lower margin of the vaſtus internus, it is diſtributed upon the inſide of the knee-joint, and inoſculates with the lower articular artery of the ſame ſide, a branch alſo of the popliteal artery; but which takes a courſe more obliquely downwards, and under the internal condyle *.

4, 5, Theſe twigs from the popliteal artery run down ſuperficially upon the heads of the gaſtrocnemius muſcle; they ſend down long twigs in company with the leſſer ſaphena vein and ſuperficial nerves; and more conſiderable branches to the origin of the ſoleus muſcle. But there is a more ſlender twig of artery (5 5), accompanying the peroneal and cutaneous nerves, prolonged from the popliteal artery, high in the ham.

6, The lower and internal articular artery.

The popliteal artery, and theſe articular arteries lie deep and near the bone. The iſchiatic nerve, and the branches it ſends off, are more ſuperficial.

7, The iſchiatic nerve—yet here, though in cloſe contact, the tibial and peroneal nerves have already ſplit.

8, The tibial nerve—where it is ſinking under the gaſtrocnemius and ſoleus, to appear again in company with the poſterior tibial artery.

9, The peroneal nerve, which paſſing over the fibula, ſinks amongſt the muſcles on the outer and fore part of the leg—it is ſeen ſplitting into a ſuperficial and a deep ſeated nerve.

10, A branch from the peroneal nerve, from which the poſterior and inferior cutaneous nerve (12) is finally derived, and likewiſe that twig called communicans peronei, which joining with (12), the ramus communicans tibiei is finally diſtributed on the outſide of the foot and toes. (Plate XX. 9.)

13, The VENA SAPHENA MAJOR—a little drawn from its ſeat, by the pulling of the integuments.

14, The POSTERIOR TIBIAL ARTERY lying parallel with the flexor communis, and with the accompanying nerve. Theſe branches which are ſeen going off, are nameleſs muſcular twigs to the ſoleus, flexor communis digitorum, and flexor policis.

16, A muſcular branch from the fibular artery. Theſe parts do not lie thus expoſed, but are covered with apponeurotic membranes, as mentioned in the introductory remarks to this diſſection.

FIG. 2.—This faint ſketch of the bones and arteries of the foot is given to illuſtrate the general courſe

* The external and inferior articular artery; making in all the four articular branches of the popliteal artery—is leſs conſtant or important. The recurrent branch of the anterior tibial artery ſometimes taking its place.

of the poſterior tibial artery; and to account for thoſe branches which are only partially ſeen in the next diſſection.

When the poſterior tibial artery (1) has got into the hollow of the inner ancle, cloſe by the heel-bone, it ſends out two branches; one goes up upon the ancle-joint, and the other (2) ramifies over the heel-bone, and inoſculates with the fibular artery. Proceeding onwards in the groove of the os calcis, it ſends off a very principal branch, viz. the INTERNAL PLANTAR ARTERY (3)—which continues a more ſuperficial branch above the tendons, while the main artery, the EXTERNAL PLANTAR ARTERY (4) takes a courſe more circuitous, deeper under the muſcles, but more towards the outer ſide of the foot.

5, The anterior tibial artery.

6 6, The plantar arch lying upon the metatarſal bones, and formed by the great inoſculation of the external plantar artery (4,) and the anterior tibial artery (5). From this arch are ſent off the arteries to the toes, viz. the perforating arteries, which, going deep betwixt the bones, inoſculate with the interoſſeous arteries of the fore part of the foot.

Pub.d as the Act Directs.

Drawn by Charles Bell

Engraved by J. Stewart Edin.r

FURTHER DISSECTION OF THE BACK PART OF THE LEG AND OF THE FOOT.

To proceed with the diſſection of the muſcles, nerves, and blood-veſſels of the calf of the leg, the heads of the gaſtrocnemius muſcle are to be lifted from their origin, and the muſcle allowed to hang by the ſoleus; we then ſee the plantaris through its whole length, lying betwixt the fleſhy bellies of theſe muſcles. By ſeparating the ſoleus muſcle from the back of the tibia, and folding the ſide of it over towards the outſide of the leg, we have the view of the parts given in Plate XIX. The ſmaller flexor muſcles are laid open—the branches of the iſchiatic nerve and poſterior tibial nerve are ſeen through all its extent, and all the important branches of the popliteal artery. We find the poſterior tibial artery, and the fibular artery running parallel to each other, high in the leg; the fibular artery is rather the more ſuperficial; but as they proceed downwards, the fibular artery ſinks behind the flexor of the great toe, and gets deep betwixt the bones. The anterior tibial artery, the firſt of theſe three great diviſions of the popliteal artery is ſeen going through betwixt the heads of the bones, to gain the fore part of the leg. (See Plate XX. Fig. 1). It is ſcarcely poſſible to give a deſcription of the deep ſeated veins accompanying theſe arteries; for, after a ſucceſsful injection of them, they are ſo numerous, as to choke and hide the arteries from the view. For as there are two VENÆ COMITES to each artery; as the tibial and peroneal arteries lie ſo little removed from each other, and as the veins form frequent communications, the arteries are involved in an irregular meſh of veins.

EXPLANATION OF PLATE XIX.

PARTS DISSECTED IN THE LEG.

A, The head of the tibia.

B, The GASTROCNEMIUS MUSCLE in outline.

C, The head of the SOLEUS MUSCLE raiſed from its origin from the tibia.

D, Marks where the tendon of the ſoleus coaleſces with the tendon of the gaſtrocnemius muſcle, to form together the tendo Achillis.

E, The ſmall tendon of the PLANTARIS, which lies betwixt the two muſcles.

F, The MUSCULUS POPLITEUS, which ariſes from the external condyle of the os femoris, paſſes fleſhy over the joint, adheres to the capſule, and is inſerted into the internal edge of the tibia.

G, The FLEXOR COMMUNIS DIGITORUM.

H, The tendon of TIBIALIS POSTICUS.

I, The FLEXOR POLICIS PEDIS LONGUS.

K, The PERONEUS BREVIS ſeen retired.

ARTERIES AND NERVES ON THE LEG.

1, The POPLITEAL ARTERY, before dividing into the three arteries of the leg. It is here, that by the violent action of the muſcles, it is ſometimes lacerated, or ſo injured, as to produce an aneuriſm, deſtroying the bones and joint.

2, The ANTERIOR TIBIAL ARTERY, where it is about to paſs through betwixt the tibia and fibula.

3, The POSTERIOR TIBIAL ARTERY, where it lies betwixt the belly of the ſoleus and the long flexor muſcles of the toes; and has its name from its ſituation in oppoſition to the anterior tibial artery.

4 4, The PERONEAL ARTERY.—This artery is ſometimes a branch of the anterior tibial artery—taking a direction parallel with the fibula, and upon the inſide of that bone, it ſupplies the peroneal muſcles and flexor of the great toe—it ſends out ſo many muſcular arteries, (ſome of which inoſculate again with the trunk), that it is much diminiſhed before it gains the lower head of the bone. Where the peroneal artery is hid under the flexor tendons, and where it lies betwixt the lower heads of the tibia and fibula, it ſplits, and ſends a branch betwixt the bones, to be diſtributed upon the outer ancle, which therefore is called the external peroneal artery.

5, The INTERNAL, or POSTERIOR PERONEAL ARTERY.—This is properly the termination of the peroneal artery—it is ſeen forming a remarkable inoſculation with the poſterior tibial artery; while its branches are chiefly ſent upon the inſide of the heel-bone, and above the plantar expanſion, upon the outſide of the foot, and inoſculating with the outer plantar artery (6).

6, The ISCHIATIC, or POPLITEAL NERVE.

7, The PERONEAL NERVE going over the head of the fibula.

8, MUSCULAR NERVE to the gaſtrocnemius muſcle.

9, A branch perforating the interoſſeous ligament.

10, The TIBIAL NERVE, where it paſſes through the head of the ſoleus, and betwixt that muſcle and the flexor digitorum—it is held aſide by a pin, ſo that the muſcular branches which it gives to the ſoleus and long flexor muſcles, may be ſeen ſtretching over the poſterior tibial artery.

11, Here the TIBIAL NERVE is about to paſs under the annular ligament, and to divide into the internal and external plantar nerves.

PARTS SEEN ON THE SOLE OF THE FOOT.

A tough granulated fat is betwixt the hard ſkin of the ſole of the foot, and the plantar apponeuroſis, which adheres ſtrongly to the apponeuroſis, and is with difficulty diſſected from it. The plantar apponeuroſis paſſes from the heel to the root of the toes, covering all thoſe parts which fill up the arch of the bones; it therefore gives elaſticity to the foot, binds down, ſtrengthens, and gives origin to the leſſer muſcles—in wounds and bruiſes it retains the blood or matter, and binds the inflammation and ſwelling, ſo as to occaſion excrutiating pain, and cauſe the deſtruction of the internal parts.

K, The middle portion of PLANTAR APPONEUROSIS, under which are contained the tendons of the long flexor muſcles, and the flexor brevis digitorum.

L, The internal lateral portion of the plantar apponeuroſis, which inveſts the ſhort muſcles of the great toe; a ſtrong faſciculus of fibres is ſeen connecting this with the middle portion.

M, The external lateral portion of the apponeuroſis. Fibres are ſent down forming partitions, or claſſing the muſcles and tendons of the foot.

N N N, The TENDONS OF THE FLEXOR COMMUNIS—the apponeurotic expanſion ſplitting to give them paſſage.

O, The tendon of the flexor of the great toe.

P, ABDUCTOR of the great toe.

Q, ABDUCTOR of the little toe.

12, The EXTERNAL PLANTAR ARTERY making a curve, and appearing more ſuperficially here, before it turns in to form the great arches from which the arteries of the toes are ſent off.

13 13 13, The ARTERIES OF THE LESSER TOES from the plantar arch.

14, The ARTERY OF THE GREAT TOE proceeding from the anterior tibial artery, where it is about to form the great inoſculation with the arch, or termination of the poſterior tibial artery.

15, The EXTERNAL PLANTAR NERVE accompanying the artery.

16, The diſtribution of the internal plantar nerve to the toes, appearing from betwixt the tendons, and ſplitting upon the arteries.

Plate XX.

Fig I

Fig II

Drawn by C. Bell and Engraved by I. Stewart Edin.r

DISSECTIONS OF THE FORE PART OF THE LEG AND FOOT.

On laying open the integuments on the fore part of the thigh, we have to take notice again of an important faſcia. The faſcia is continued down the leg from the hamſtring tendons—it takes a firm hold of every acceſſible point of bone; the head and ridge of the tibia, the fibula, and the whole capſule of the knee is covered and ſtrengthened by the faſcia—below, upon the ancle, it is gathered into ſtronger faſciculi, which encircle the tendons confining them, and forming the annular ligament.

The ſaphena vein upon the inſide of the tibia accompanied by the internal cutaneous nerve, ſhould not be overlooked. Upon the outſide of the leg, about its middle part, and before the fibula, is ſeen a great branch of the peroneal nerve coming out through the faſcia; and a little further down another branch; both ſpreading extenſively over the fore part of the foot.

To proceed with the diſſection, and bring the parts to correſpond with Plate XX. we diſſect off the faſcia from the extenſor muſcles, ſeparating it from its ſtrong connection with the tibia, and folding it back over till we find it taking a firm hold on the fibula. We find, as it is diſſected up from the tibialis anticus, extenſor policis, extenſor digitorum, communis and peroneus longus, that the ſurface of theſe muſcles are ragged, where they took their origin from the faſcia.

Upon the fore part of the foot, in like manner, an expanſion is ſtretched over the muſcles and tendons, above which run the cutaneous veins and nerves.

EXPLANATION OF PLATE XX.

Fig. 1.—A, The patella—B, Ligament of the patella, connecting it with the head of the tibia.

C, The ridge of the tibia.

D, Head of the fibula—E, Lower end of the fibula, forming the guard of the joint in this direction.

F, The faſcia cut up from the tibia, diſſected off the extenſor muſcles, and held back—its firm origin from the head of the fibula is ſeen, and the manner in which it forms the ligament of the ancle G, by taking a firm hold of the extremities of the bones, and by being ſtrengthened with additional faſciculi of fibres.

MUSCLES.

H, The tibialis anticus muſcle taking its origin from the tibia, and from the tendinous partitions. Its tendon is ſeen in a diſtinct ſheath of the annular ligament—it turns obliquely over the foot, and is inſerted into the os cuneiforme internum.

I, The EXTENSOR POLICIS, it ariſes from the fibula, paſſes under the ligament, and over the firſt joint of the great toe, to be inſerted into the ſecond.

K, The EXTENSOR LONGUS DIGITORUM BREVIS.—It ariſes from the head of the tibia, from the faſcia and tendinous partitions betwixt the bones and edge of the fibula. Its fibres are ſeen to ſplit as they paſs under the ligament, and are ſent to the four leſſer toes, accompanied by the tendons of the extenſor digitorum brevis.

L, The PERONEUS LONGUS ariſing from the head and ridge of the fibula, and from the upper part of the tibia. Its tendon paſſes behind the outer ancle. It is inſerted into the metatarſal bone of the great toe and os cuneiforme magnum.

The PERONEUS BREVIS lies under the laſt muſcle. It ariſes from the ridge of the fibula and interoſſeous ligament, and its tendon paſſes in the ſame ſheath with the peroneus longus. Its tendon M runs on the outer edge of the foot, and is inſerted into the metatarſal bone of the little toe.

N N, Mark the faſciculi of the EXTENSOR DIGITORUM BREVIS. It riſes from the heel-bone and annular ligament—its ſmall tendons run ſo obliquely inwards, as to croſs thoſe of the long extenſor paſſing between them. That tendon which is ſeen going to the great toe is implanted into the firſt bone. The other tendons which go to the three next toes are prolonged alongſt the ſide of the toes, the great tendon gliding betwixt them.

ARTERIES AND NERVES.

1, The moſt important part of the demonſtration is the track of the ANTERIOR TIBIAL ARTERY (1), and its accompanying nerve. The manner in which the ANTERIOR TIBIAL ARTERY paſſes betwixt the heads of the tibia and fibula is ſeen in the laſt plate. It appears here (1), lying deep betwixt the tibialis anticus and extenſor communis digitorum muſcles. It is here guarded by the projecting ridge of the tibia, and covered by the belly of the tibialis anticus muſcle. It gives off alternately to each ſide muſcular branches; as it deſcends, it becomes more ſuperficial, and is much expoſed in workmen to be wounded with the adze, and in the upper part, it lies cloſe upon the interoſſeous membrane; but as it deſcends, it turns round, and lies before the head of the tibia, and paſſes through the annular ligament under the tendon of the extenſor of the great toe.

2 2, A very remarkable recurrent branch ſent off from the anterior tibial artery, immediately after it has perforated the interoſſeous membrane; from the root of this twig, there is ſent down under the fleſhy head of the extenſor digitorum communis, a ſlender muſcular branch. The twig which is ſeen here, perforates the head of the tibialis anticus muſcle, runs upon the head of the tibia, gets under the ligament of the patella, while its extreme twigs are extended over the ligament of the knee, and inoſculate with the ARTERIA ARTICULARIS SUPERIOR EXTERNA (1) appearing here from under the tendon of the biceps muſcle, and derived from the popliteal artery.

4, The peroneal nerve which we ſaw in the laſt plate, derived from the great iſchiatic nerve in the ham.

5, Its deep ſeated branch which appears again in company with the artery, and ſeparated from it by a pin (7).

6, The ſuperficial branch which is diſtributed to the peroneal muſcles, and ſuperficially upon the fore part of the foot, coming out from beneath the faſcia at (8.) and turned aſide by the raiſing of the faſcia.

9, A nerve likewiſe diſtributed upon the fore part and ſide of the foot, and derived from the cutaneous nerve, which in the laſt plate is ſeen running down ſuperficially upon the tendon of the gaſtrocnemius muſcle, properly the nervus communicans tibiei, which is obſerved to join with the NERVUS COMMUNICANS PERONEI on the back of the leg.

10, The commencement of the vena ſaphena; here we fix our tubes to inject the whole ſyſtem of the veins of the leg.

FIG. 2.—This ſketch of the foot from Haller is added chiefly to ſhow the further diſtribution of the anterior tibial artery.

A, The tendon of the tibialis anticus muſcle.

B, The tendon of the extenſor policis.

C, The tendons of the extenſor communis digitorum.

D, The tendon of the peroneus brevis.

E, The extenſor brevis digitorum pedis.

DISTRIBUTION OF THE ARTERY.

1, ANTERIOR TIBIAL ARTERY.

2, Muſcular branches.

3, INTERNAL MALEOLAR ARTERY.

4, EXTERNAL MALEOLAR ARTERY—it inoſculates with the fibular and tarſal arteries.

5, The TARSAL ARTERY diſtributed to the bones and joints of the tarſus, and to the extenſor brevis—it ſometimes gives off the interoſſeous arteries.

6, Ramus in talo. n. T. A.

7 7, The termination of the trunk of the anterior tibial artery going down by the metatarſal bone of the great toe into the ſole of the foot.

8, The metatarſal artery giving off the interoſſei.

9, Arteria dorſalis policis.

10, Branches of the plantar artery to the toes.

END OF VOLUME THE FIRST.

DIRECTIONS TO THE BINDER.

The Pages numbered 1, 2, 3, and 4, to follow the Title Page of Part V.

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APPENDIX

TO

SYSTEM OF DISSECTIONS,

PART FIRST;

CONTAINING

ADDITIONAL DESCRIPTIONS

OF THE

ABDOMINAL MUSCLES.

BY CHARLES BELL,

FELLOW OF THE ROYAL COLLEGE OF SURGEONS.

EDINBURGH:

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1800.

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Engraved by I. Grant

Drawn by Chas. Bell

Publd as the act Directs for Chas Bell Edinr 1809.

APPENDIX.

As I have propoſed to take every poſſible opportunity of correcting and amending the deſcriptions of this book, and of giving additional Tables, I was happy to have it in my power, during laſt winter, to add the following Plate, drawn from a very ſtrong and well-proportioned ſubject, as it lay diſſected for public demonſtration. It is not in every ſubject that we find theſe muſcles ſtrong and eaſily diſſected; but in ſailors, eſpecially in boatmen, we have them particularly well marked; for, in conſequence of their habitual exertion in raiſing the lower parts of their bodies by their arms, or in pulling at the oar, the abdominal muſcles acquire a maſſineſs and ſtrength not to be ſeen in other workmen.

In the firſt Plate, the EXTERNAL OBLIQUE MUSCLE (B b b) and its tendons, with the more ſuperficial parts, are ſeen on the left ſide, while, on the right ſide, the EXTERNAL OBLIQUE MUSCLE (F f) being diſſected off, the RECTUS and the INTERNAL OBLIQUE MUSCLES (D E), are ſeen. But to underſtand the anatomy of theſe muſcles, and of the parts connected with them; to underſtand, in particular, the anatomy of the ring, and the nature of the tendinous lines, the linea ſemilunaris, and the linea alba; it is neceſſary to have a more complete view of the diſſection of the internal layers of muſcles.—In this additional Plate of the abdominal muſcles, therefore, the right ſide of the body is ſhewn further diſſected than in the firſt Plate—The EXTERNAL OBLIQUE, which is held out by the hook, and the INTERNAL OBLIQUE, which is held out by the fingers of the diſſecter, are diſſected up from their places, ſo as to ſhew the TRANSVERSALIS MUSCLE lying in its place—We ſee all the connexions of the muſcles at the LINEA SEMILUNARIS; we ſee the deficiency of the TRANSVERSALIS MUSCLE on the lower part, and the bowels protruding, covered only by the PERITONEUM; we ſee alſo the manner in which the RING is formed by the tendon of the external oblique; the origin of the CREMASTER MUSCLE; the manner in which the cord lies in the groove of Paupart's ligament; and the ſituation of the EPIGASTRIC ARTERY.

In Fig. 2. we have an enlarged view of this internal ſtructure of the ring, the relative ſituation of the ſpermatic cord, cremaſter muſcle, and epigaſtric artery. In this view of the parts we ſee only the tendon of the external oblique raiſed, fibres of the internal oblique in their natural ſituation, and the cremaſter muſcle derived from them.

EXPLANATION OF ADDITIONAL PLATE I.

To bring the parts into the ſituation in which they are now preſented to us, we diſſect in the manner deſcribed, page 6. under the title of Second Stage of Diſſection.—Here the external oblique muſcle of the

right ſide is diſſected from its ſerrated origins upon the ribs, and from its origin from the ſpine of the os ILII, and folded back; and as it is taken up, it is cut from its connexions at Paupart's ligament, with the faſcia of the thigh, ſo as to be left at its final inſertion into the creſt of the os PUBIS. When the external oblique is diſſected up, until we find its tendon intimately connected at the linea ſemilunaris, we then ſee the internal oblique muſcle, which is marked in the firſt Plate D E, taking its origin from the os ilium, and ſpreading its fibres upwards to the ribs directly acroſs to the linea ſemilunaris, and obliquely downwards to the pubis; at the lower angle we ſee the fibres paſſing off from this muſcle to form the cremaſter muſcle. We then cut this muſcle from its origin, and diſſect it back as we have done the external oblique muſcle; betwixt the layers of theſe muſcles there is much adipoſe membrane, which muſt be carefully diſſected, as I have formerly deſcribed.

A A, THE INTEGUMENTS diſſected from the belly.

B, THE RIBS of the right ſide.

C, THE SPINE of the ilium.

D, The TENDON of the EXTERNAL OBLIQUE MUSCLE of the left ſide, where it forms the ſheath of the rectus muſcle.

E, THE LOWER PORTION OF THE TENDON OF THE RIGHT SIDE, going down to form the RING.

F, THE SPERMATIC CORD of the ſame ſide.

G, That part of the EXTERNAL OBLIQUE MUSCLE of the right ſide, which takes its origin from the os ILIUM, held out by the hook.

H, The TENDON of the EXTERNAL OBLIQUE MUSCLE, where it is inſerted into the creſt of the os PUBIS. What is ſaid in page 98. and 99. under the title of the LIGAMENT OF THE THIGH, and its connexion with the ABDOMINAL RING, will now be fully underſtood; for it may be ſeen here, that that portion of the tendon of the ABDOMINAL MUSCLE, which forms the lower PILLAR OF THE RING, is inſerted flat and horizontally into the os PUBIS; ſo that when the tendon is in its natural ſituation, the ſpermatic cord lies in it as in a groove, and when cutting up the femoral ligament, or Paupart's ligament, as it is called, to free the CRURAL HERNIA from ſtricture (I ſpeak from experiments on the dead body), if we carry our knife obliquely inwards, ſo as to avoid the apparent direction of the epigaſtric artery, we cut upon the cord before we have cut through the ligament.

I, THE SPERMATIC CORD, coming out from amongſt the fat, and from under the peritoneum. It is ſeen to proceed obliquely downwards, and to paſs over the tendon H into the ſcrotum. There appears no veſtige of the original formation of the coats of the teſticle, as explained in page 79.

K, Small nerves paſſing from the lumbar nerves to the ſpermatic cord.

L, Fibres of the FASCIA OF THE THIGH, which were connected irregularly with the tendon of the EXTERNAL OBLIQUE.

M, THE FEMORAL ARTERY.

N, The great FEMORAL VEIN.

O, The EPIGASTRIC ARTERY. It is this artery which is marked Plate I. fig. 2. and it is ſeen there, that in the femoral hernia, this artery muſt ſtretch over the neck of the protruding ſac. Although there be no inſtances of this artery being cut in the operation for femoral hernia, yet we ought carefully to attend to it; for in all probability the caution which has been hitherto inculcated, in regard to this artery, has been a principal cauſe of its never having been cut. But, indeed, if we attend to the natural ſituation of the parts before the ligament is nicely diſſected, we ſhall ſee, that the femoral artery gives off this epigaſtric branch ſome way higher up than the edge of the ligament, and the artery taking its direction obliquely upwards, is conſiderably removed from the knife when the tendon is to be cut in the middle betwixt the ſpermatic cord and the femoral artery.

Beſides, in the crural hernia, it will be always ſufficient to cut the neck of the ſac, and the inflamed

and condenſed cellular membrane, ſcarcely ſnipping the edge of the tendon. Here, too, it may be obſerved, the edge of the tendon is protruded downwards from its natural ſituation. It may be obſerved alſo, that it is the ſwelling of the ſofter and more vaſcular parts conſtricted by the tendon which cauſes incarceration, or ſometimes the flatus or fæces collected in the protruded gut itſelf. See further what is ſaid, page 82. under the title of METHOD OF DISSECTING HERNIÆ.

Another circumſtance may be obſerved in this figure regarding the femoral ligament: That what has been obſerved by ſome authors of the ſtricture of the femoral hernia, viz. that it is not upon the external margin of the ligament that the tenſion is found, but more internally under the ligament, and towards the pubis, is not a conceit, but likely to happen from the natural ſtate of the parts; this ſtrangulation being evidently the inner margin of that broad horizontal inſertion of the tendon into the bone.

But in all the caſes in which I have had an opportunity of diſſecting femoral hernia, the patients have been females; and the parts were ſo inflamed and condenſed together, that I could ſcarcely diſtinguiſh the courſe of the epigaſtric artery. In thoſe caſes where I would have been moſt attentive to this circumſtance, the operation had been unſucceſsfully performed, or there had been extenſive ſinuſes from the mortification of the gut and the eſcape of the fæces, which prevented me from obſerving what really formed the ſtrangulation. It muſt be recollected, that in diſſecting the tendon of the pſoas parvus muſcle, we ought to attend to its inſertion into the os pubis, and connection with the tendon of the external oblique; for in all likelihood the deficiency in the pillars of the ring, occaſioning hernia, depends upon this connexion, perhaps in ſome caſes the want of this muſcle.

P, The peritoneum ſeen, with the inteſtines ſhining under it. This outer ſurface of the peritoneum is not ſmooth like the inner ſurface, which allows the inteſtines to glide ſmoothly under it, for it here is connected with the muſcles by cellular membrane. It is here that inflammation, in conſequence of wounds, or after the operation for the ſtone or puerpueral inflammation, ſometimes forms extenſive abſceſſes.

Q Q, The INTERNAL OBLIQUE, held out by the hand of the diſſecter.

R, CREMASTER MUSCLE, being a faſciculus of fibres derived from the laſt muſcle.

S, INSERTION of the INTERNAL OBLIQUE into the LINEA SEMILUNARIS, or rather the union and intermixing of the fibres of this muſcle with the tendons of the other muſcles at this line.

T, The TRANSVERSALIS ABDOMINIS. Its ſtrong fleſhy fibres are ſeen to run directly acroſs the belly. It ariſes from the ſix lower ribs forming indigitations with the DIAPHRAGM from the tranſverſe proceſſes of the four lower lumbar vertebræ, and from the ſpine of the ilium.

X X, The termination of the muſcular part of the TRANSVERSALIS MUSCLE before mingling its tendon with that of the INTERNAL OBLIQUE, S.

V, That part of the MUSCLE which ariſes from the ribs.

The origin of the RECTUS MUSCLE from the ſyphoid cartilage, and the mixing of its fibres with the great pectoral muſcle, is diſtinctly ſeen.

EXPLANATION OF FIG. II.

In this figure we have an enlarged and more diſtinct view of the diſſection of the ABDOMINAL RING.

A, The SPERMATIC CORD emerging from the fat, and from under the PERITONEUM.

B, The SPERMATIC CORD after it has paſſed the tendon of the EXTERNAL OBLIQUE MUSCLE.

C, The TENDON of the EXTERNAL OBLIQUE MUSCLE.

D, The FIBRES of the INTERNAL OBLIQUE MUSCLE.

E, The CREMASTER MUSCLE; being a few muſcular fibres derived from the INTERNAL OBLIQUE MUSCLE, and deſcending through the RING, and expanding upon the CORD.

F, The EPIGASTRIC ARTERY.

G, A branch of the EPIGASTRIC ARTERY going to the cord.

I, Fibres of the faſcia of the thigh.

K, A branch of the inguinal nerves going to the cord.

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